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National Dioxin Study Tier 4
Combustion Sources
Initial Literature Review and Testing Options

Radian Corp., Research Triangle Park, NC

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16. ABSTRACT

The objective of Tier 4 of the National Dioxin Study is to determine if combustion sources emit significant amounts of dioxins to the atmosphere. The literature review was performed prior to the initiation of the Tier 4 dioxin emissions test program. The purpose of the literature review was to summarize the existing dioxin emissions data base for combustion sources and to develop a list of candidate source categories for the test program.

The literature review presents a summary of the available dioxin emissions data and discusses factors affecting dioxin emissions from combustion sources. A preliminary ranked list of source categories recommended for the Tier 4 test program is presented, along with an overview of the recommended testing approach.

A tabular summary of the dioxin emissions data base and a comprehensive reference list are included as appendices.

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Initial Literature Review And Testing Options

By
Radian Corporation
Research Triangle, NC 27709

Contract No. 68-02-3513
EPA Project Officer: William H. Lamason

U.S. ENVIRONMENTAL PROTECTION AGENCY
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EXECUTIVE SUMMARY

The purpose of Tier 4 of the National Dioxin Study is to assess combustion source emissions of primarily 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and, secondarily, other chlorinated dioxin and furan homologues. Radian Corporation has been contracted by the U. S. Environmental Protection Agency (EPA) to review and evaluate dioxin emissions data from the literature and propose a test plan for the Tier 4 program. This report summarizes the results of the review and evaluation and presents a proposed test plan.

Radian conducted a literature review on dioxin emissions from combustion processed early in 1984. In addition, contacts were made with key individuals to identify recently performed or ongoing studies that could be used to supplement the data base. Based on the available information, a preliminary list of source categories with the potential to emit dioxins was developed. The preliminary list was then ranked based on potential to emit dioxins, number of previous dioxin tests in a source category, and potential human exposure. Table 1 presents the preliminary ranked list. Highly ranked source categories are recommended for stack testing early in the Tier 4 program. Rank A sources will be tested initially. The Tier 4 budget will allow for approximately 12 source stack tests. A relatively inexpensive ash screening procedure will be used to help classify categories that will not be stack tested.

Ash screening will be conducted on Rank B and C sources, along with sources requested by State and regional offices. Results of the ash screening will be used to qualitatively assess other sources not stack tested.

This document was written to provide input in the design of the National Dioxin Study Tier 4 project plan. Since the writing of this report, numerous comments concerning the Tier 4 project plan have been received, and the Tier 4 project plan has been revised. The contents of this report do not incorporate all of the revisions. This report,

TABLE 1. RANKED SOURCE CATEGORY LIST

Rank A Source Categories

- Sewage Sludge Incinerators
- Black Liquor Boilers

Rank B Source Categories

- PCP Sludge Incinerators
- Carbon Regeneration (Industrial)
- Charcoal Manufacturing
- Wire Reclamation

Rank C Source Categories

- Commercial Boilers Burning Hazardous Waste
- Wood Stoves
- Wood Boilers (PCP Treated Wood)
- Mobile Sources
- Small Spreader Stoker Coal Boilers
- Hazardous Waste Incinerators
- Lime/Cement Kilns Cofired with Hazardous Wastes
- Hospital Incinerators
- Forest Fires
- Agricultural Burning
- Apartment House Incinerators

Rank D Source Categories

- Municipal Solid Waste (MSW) Incineration
- Industrial Boilers Cofiring Wastes

Rank A - Large source categories (greater than 1 million tons of fuel and/or waste burned annually) with elevated dioxin precursor contamination of feed/fuel. These categories have the potential to emit TCDD and require further testing.
Rank B - Small source categories (less than 1 million tons of fuel and/or waste burned annually) or source categories with limited dioxin precursor contamination of feed/fuel. These categories have the potential to emit TCDD and require further testing.
Rank C - Source categories less likely to emit TCDD.
Rank D - Source categories that have already been tested three or more times.

therefore, differs from the Tier 4 project plan in several instances. Persons interested in obtaining a copy of the final Tier 4 Project Plan should contact William Lamason, Air Management Technology Branch, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

1.0 INTRODUCTION

1.1 BACKGROUND

The Air Management Technology Branch within the EPA's Office of Air Quality Planning and Standards (OAQPS) is responsible for the development and implementation of a source testing program for Tier 4 of the National Dioxin Study. The purpose of Tier 4 is to assess combustion source emissions of polychlorinated dibenzo-p-dioxin (PCDD), with a focus on the most toxic isomer - 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Combustion source emissions of polychlorinated dibenzofuran (PCDF) will also be addressed in this study.

Radian Corporation, under task order contract, is providing support to the Air Management Technology Branch (AMTB) by collecting and reviewing available literature data on combustion related emissions sources of PCDD's and PCDF's. Based on information available in the literature and the Tier 4 budget, a source test plan has been developed that will address the following questions:

1. Which combustion source categories emit PCDD's (and PCDF's) to the atmosphere?
2. What range of concentrations of PCDD's (and PCDF's) are emitted from these source categories?

Dioxins are members of a family of organic compounds known chemically as dibenzo-p-dioxins. The common aspect of all dioxin compounds is that they have a three ring nucleus containing two benzene rings interconnected through a pair of oxygen atoms. The structural formula of the dioxin nucleus and the convention used in numbering its substituent positions are shown in Figure 1-la. Theoretically, one to eight chlorine atoms can occur at dioxin substituent positions such that 75 different chlorinated dioxin isomers are possible. Each isomer has its own physical and chemical properties and differs from others in the number and relative position of its chlorine atoms. The schedule of potential chlorinated dioxin isomers

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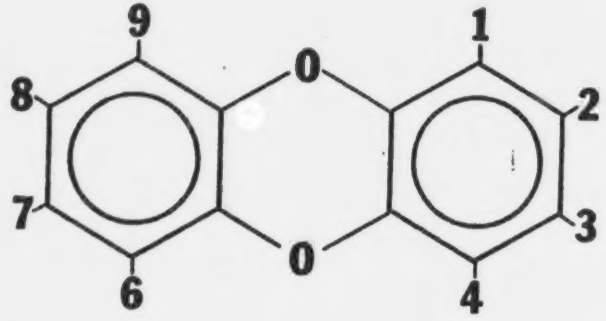
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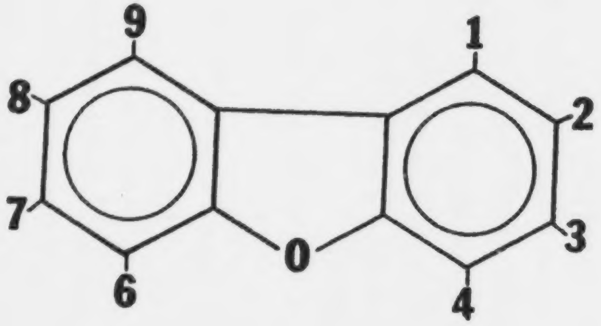
a. Dioxin configuration.



b. Furan configuration.

Figure 1-1. Dioxin and furan configurations showing the dioxin and furan nuclei and conventional substituent numbering system.

is given in Table 1-1. The abbreviations given in this table for chlorinated dioxin homologues are used throughout this report.

Furans are a group of organic compounds chemically known as dibenzofurans. They have a similar structure to the dibenzo-p-dioxins except that the two benzene rings in the nucleus are interconnected with a five member ring containing only one oxygen atom. The structural formula of the furan nucleus and the convention used in numbering its substituent positions are shown in Figure 1-1b. Theoretically, the chlorinated furan group can contain up to 135 different structural isomers, each with varying physical and chemical properties. The schedule of potential chlorinated furan isomers is given in Table 1-2. The abbreviations given in this table for chlorinated furan homologues are used throughout this report.

1.2 APPROACH AND LIMITATIONS TO THIS STUDY

This study was accomplished in three general tasks. The first task was to obtain and review the available literature on PCDD emissions from combustion sources. Over 100 published and unpublished reports were obtained. In addition, contacts were made with key individuals to identify recently performed or ongoing studies that could be used to supplement the data base. The second task was to develop a ranked list of source categories with potential to emit PCDD's. The criteria used to develop the ranked list was based on information obtained from the literature review. The final task was to develop a testing program to assess PCDD (and PCDF) emissions from combustion sources. Again, the results of this task were largely based on the outputs of the first two tasks.

During the development of the source test plan, it became apparent that the Tier 4 budget would allow for only about 12 stack tests. Obviously, this number of tests will be inadequate for characterizing all of the source categories being considered. It will be equally inadequate for characterizing any single source category with statistical significance. The source ranking procedure is an attempt to predict which categories are most likely to emit PCDD's and, therefore, should be stack tested. However, the ranking procedure is largely subjective, since no realistic assignment

TABLE 1-1. SCHEDULE OF THEORETICAL CHLORINATED DIOXIN ISOMERS

Chlorinated Dioxin Compound	Number of Isomers
Monochlorodibenzo-p-dioxin (MCDD)	2
Dichlorodibenzo-p-dioxin (DCDD)	10
Trichlorodibenzo-p-dioxin (T_3CDD)	14
Tetrachlorodibenzo-p-dioxin (TCDD)	22
Pentachlorodibenzo-p-dioxin (P_5CDD)	14
Hexachlorodibenzo-p-dioxin (H_6CDD)	10
Heptachlorodibenzo-p-dioxin (H_7CDD)	2
Octachlorodibenzo-p-dioxin (OCDD)	1
TOTAL	75

TABLE 1-2. SCHEDULE OF THEORETICAL CHLORINATED FURAN ISOMERS

Chlorinated Furan Compound	Number of Isomers
Monochlorodibenzofuran (MCDF)	4
Dichlorodibenzofuran (DCDF)	16
Trichlorodibenzofuran (T_3CDF	28
Tetrachlorodibenzofuran (TCDF)	38
Pentachlorodibenzofuran (P_5CDF)	28
Hexachlorodibenzofuran (H_6CDF)	16
Heptachlorodibenzofuran (H_7CDF)	4
Octachlorodibenzofuran (OCDF)	1
TOTAL	135

of weighing factors could be made for each of the ranking criteria. The development of a ranked list would change depending on the relative importance given to the ranking criteria. A screening tool would be beneficial to prevent wasting of limited resources.

Because of the tight schedule, limited budget, and large number of source categories, a PCDD scan* of ash samples was selected as a quick and inexpensive screening tool. Although the ash screening cannot be used as an absolute ranking tool, this method can provide a relative indication of which source categories warrant further study. Source categories identified by OAQPS along with sources suggested by State and regional offices will be screened.

1.3 CONTENTS OF THIS REPORT

Section 2.0 presents a summary of the literature review. Tetrachlorodibenzo-p-dioxin (TCDD) emissions data are presented along with qualitative information on source characteristics. A complete listing of the emissions information along with sampling and analytical methodologies used to obtain the data is presented in Appendix A. Ongoing research is also identified in Section 2.0.

The source category characteristics and emission rates summarized in Section 2.0 are used in Section 3.0 to identify factors that affect TCDD emissions. These factors include both fuel and combustion characteristics. The factors identified are based on experimental studies, source tests, and theoretical chemistry. No attempt was made to assign a relative importance to these factors.

In Section 4.0, a ranked list of source categories is developed. The ranking procedure is largely based on the factors affecting TCDD emissions identified in Section 3.0. In addition, the size of the source category, the number of previous PCDD studies, and the potential for human exposure are considered during the ranking. As discussed earlier, the ranking procedure is largely subjective, and the final ranked list may be modified.

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* PCDD Scan is a lower resolution integration of GC/MS output for tetra- through octa-dioxin homologues.

Section 5.0 presents a recommended testing program based on the ranked list of source categories. The testing program will include ash screening of approximately 45 sources and stack testing of the sources of greatest concern. Section 5.0 also discusses the costs of stack testing, the number of sources that should be tested in each source category, and the types of samples that should be analyzed at each source.

2.0 SUMMARY OF AVAILABLE DATA

A literature review for sources of PCDD and PCDF air emissions was made in 1983 by the Pollutant Assessment Branch (OAQPS/PAB).[1] This review was used as a starting point for a more focused literature search concerning PCDD emissions from combustion sources in early 1984. In addition, contacts were made with key individuals to identify recently performed, ongoing, or planned studies that could be used to supplement the data base. Contacts included personnel from the Canadian Government, EPA personnel, and researchers from industry and universities. Primarily, members of the EPA's Chlorinated Dioxin Working Group and authors of key references were contacted.

This chapter summarizes the updated literature review and provides the data base upon which the Tier 4 testing program was developed. Confirmed and potential sources of PCDD and PCDF air emissions are identified. Industrial, commercial, and residential combustion sources are identified by testing. Experimental studies suggest additional potential sources of emissions. Quantitative data are presented on TCDD emission rates, along with qualitative information on the source characteristics and feed composition. Theories are also presented on dioxin formation mechanisms and conditions that promote dioxin formation.

2.1 COMBUSTION SOURCES TESTED

A review of the literature has produced a list of 12 broadly defined source categories for which some dioxin emissions data has been collected:

- Municipal Waste Combustors,
- Hazardous Waste Incinerators,
- Sewage Sludge Incinerators,
- Coal Fired Utility Boiler,
- Commercial Boilers Firing Waste Oil,
- Industrial Boilers Cofiring Wastes,
- Carbon Regeneration,
- Residential Wood Combustion,

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- Mobile Sources,
- Wire Reclamation,
- Lime/Cement Kilns Cofiring Hazardous Wastes, and
- Electrical Transformer Fires.

Table 2-1 lists tested sources and the TCDD concentrations detected. Although the National Dioxin Study is focusing on 2,3,7,8-TCDD, most of the data found in the literature addressed TCDD and PCDD. Since 2,3,7,8-TCDD data are limited, TCDD has been used during the evaluation of the data base as the best representative of 2,3,7,8-TCDD emissions. Whenever possible, stack test results were recorded. Much of the literature is focused on the analysis of ash samples due to the ease of collection. However, these samples are often not representative of stack emissions. The possibilities of PCDD partitioning in the ash and PCDD enrichment on the fine particulate are discussed in greater detail on Section 5.0.

General source characteristics are summarized in Table 2-2. Source characteristics are used to identify factors that affect PCDD emissions. Based on these factors, other potential sources of PCDD emissions are identified for the testing program. In several cases, PCDD studies have not been cleared for public use. For these studies, the sources are described, but no emissions data are provided. Appendix A provides a complete listing of the dioxin data bases. The data base lists levels of PCDD detected, source characteristics, precursors, and sampling/analytical methodology. Based on the information provided, the data are rated as good (G), poor (P), or incomplete (I). The rating is a function of sampling/analytical procedures, detection limits, and completeness. The following discussion summarizes the data available on source categories identified in the literature review.

2.1.1 Municipal Waste Incineration

In 1978, TCDD's were detected in the emissions of the Hempstead municipal waste combustor (MWC) on Long Island. Since that date, this source category has received considerable attention in the United States. The Canadian Government has identified MWC's as one of the major combustion

TABLE 2-1. COMBUSTION SOURCES FOR WHICH TCDD TEST DATA ARE AVAILABLE

Source Category	Number of Facilities Tested	TCDD[a]			2,3,7,8-TCDD		References
		Sample	Mean	Range	Mean	Range	
Municipal Waste Combustors							
USA	7	Stack	3.5 ng/m^3	ND-240 ng/m^3	3.5 ng/m^3	0.30-9.1 ng/m^3	8,9,10,11
European	13	Stack	25.6 ng/m^3	ND-128 ng/m^3	–[b]	-	3,4,5,6,38
Hazardous Waste Incinerators							
Incinerator Ship	2	Stack	ND[c]	ND	-	-	18,19
Land Based Incinerators	10(7)[d]	Stack	0.56 ng/m^3	ND-2.5 ng/m^3	ND	e	13,14,15,16
Sewage Sludge Incinerators	1	Stack	f	f	-	-	27
Utility Coal Boilers	7	Stack	ND	ND	-	-	8
Commercial Boilers (Waste Fired)	6(6)[d]	Stack	g	g	-	-	87
Industrial Boilers (Waste Fired)	6(1)[d]	Stack	10.13 ng/m^3	ND-40.5 ng/m^3	18,000 ppt[h]	ND-55,000 ppt	20,22,24,25
Activated Carbon Regeneration	1	Stack	0.175 ng/dscm	0.06-0.30 ng/dscm	0.10 ng/dscm	0.01-0.21 ng/dscm	32
Residential Wood Combustion	4	Scrapings	329 ppt	ND-777 ppt	242 ppt	26-600 ppt	25,38
Mobile Sources	9(4)[d]	Exhaust	4.0 ppt	ND-20 ppt	3.0 ppt	*	25,39
Wire Reclamation Incinerators	1	Scrapings	234 ppt	58-410 ppt	-	-	33
Lime/Cement Kilns (Waste Fired)	1(1)[d]	Stack	g	g	-	-	26
Accidental Electrical Equipment Fires[k]	2	Wall Swipes	44 ppm[l]	ND-195 ppm	0.059 ppm,	*	34,35

[a] TCDD = Tetrachlorodibenzo-p-dioxin.

[b] Dash = No Data.

[c] ND = None detected (Detection limits vary).

[d] Number of tests have been performed, but the results have not been officially reported.

[e] = One datum, no range available.

[f] PCDD scan only. PCDD concentrations ranged from 483 ng/m^3 to 1,140 ng/m^3 with a mean of 739 ng/m^3.

[g] Results have not yet been officially reported.

[h] ppt = Parts per trillion by weight.

[i] Fuels include wood, wood/oil mixture, and natural gas.

[j] Fuels include diesel, unleaded and leaded gasoline. In one test series, exhaust scrapings were analyzed, in the other series, filter medium from exhaust samples.

[k] Includes PCB transformers and capacitor batteries.

[l] ppm = parts per million by weight.

TABLE 2-2. CHARACTERISTICS OF SOURCES TESTED FOR DIOXINS

Source	Precursors	Furnace Type	Temperature	Available[a] Air
Municipal Waste Combustors				
- Conventional	Chlorinated aromatics	Waterwall	500-1000°C	Low
- Refuse derived fuel boilers	Chlorinated aromatics	Spreader Stoker	1000°C	Excess
Hazardous Waste Incinerators				
- Land Based	PCBs, PCPs	Rotary Kiln	1200°C	Excess
- Incinerator Ships	PCBs, PCPs	Dual Chamber	1600°C	Excess
Sewage Sludge Incinerators	PCBs, chlorinated aromatics	Multiple Hearth	450-950°C	Low
Utility Coal Boilers	Coal, low chlorine	Pulverized Coal	1200°C	Excess
Commercial Boilers (Waste Fired)	TCP	Small Fire Tube	1000°C	Excess
Industrial Boilers (Waste Fired)	PCP, chlorinated aromatics	Liquid injection/ Stoker	1300°C	Excess
Activated Carbon Regeneration	PCBs	Fluidized Bed	750-1000°C	Limited
Residential Wood Combustion	Low chlorine	Woodstove/Fireplace	<500°C	Low
Mobile Sources	Low chlorine	Internal Combustion Engine	1800-2500°C	Excess
Wire Reclamation Incinerators	PCBs, PVCs	Batch/Conveyor	500°C	Limited
Lime/Cement Kilns (Waste Fired)	Chlorinated organics	Rotary Kiln	1400°C	Excess
Accidental Transformer Fire	PCBs, Cl-benzenes	Uncontrolled PCB Oil Fire	NA[b]	NA

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[a] Excess: high air/fuel ratio with efficient mixing.
Low: high air/fuel ratio with inefficient mixing.
Limited: designed for low air/fuel ratio.

[b] N/A = Not Available.

sources of PCDD's in the Canadian environment.[2] Numerous tests have also been conducted in Europe and Japan.[3,4,5,6,7]

MWC's can be classified as either large mass burn units, refuse derived fuel (RDF) units, or small modular units. There are approximately 90 modular units, 40 mass burn units, and 11 RDF boilers currently operating. The mass burn units are responsible for the majority of waste burned. These units are characterized by low combustion temperatures (500-1000°C) and poor air/fuel mixing. Of the seven MWC's tested in the United States, three are large mass burn units, three units are RDF fired, and one unit is modular. The TCDD emission rates measured at these sources ranged from none detected (ND) to 240 ng/m^3 (Table 1-1).

The only study with no PCDD's detected was a spreader stoker boiler that cofired RDF with coal.[8] The furnace temperature was 1200°C. Two other facilities with low levels of TCDD's detected are another incinerator boiler (3.15 ng/m^3) and a small modular unit (1.2 ng/m^3).[9] Both facilities were equipped with secondary chambers for combustion of offgases. The remaining units, both mass burn units and RDF units, emitted higher levels of TCDD's (6.3-240 ng/m^3).[8,9,10,11] These sources were characterized by no supplemental fuel, no secondary combustion chambers, and, in some cases, poor air/fuel mixing. One unit added a chlorinated biocide to the RDF.[10]

Many of these units are equipped with electrostatic precipitators or cyclones to remove the large particulate from stack emissions. However, Karasek *et al* has shown that in some cases PCDD's enrich on the smaller particulate.[12] A large portion of these may not be removed by the above control devices.

2.1.2 Hazardous Waste Incineration

The incineration of hazardous wastes can be divided into four categories:

(1) Land Based Incinerators,

(2) Incineration Ships,

(3) Boilers Cofiring Hazardous Wastes, and

(4) Lime/Cement Kilns Cofiring Hazardous Wastes.

In each case, the feed material may contain elevated levels of chlorinated aromatics or PCDD's. Based on fuel composition, the potential for PCDD emissions is high. Fuel characteristics are discussed further in Section 3.0. In spite of the fuel composition, well controlled source design allows for high efficiency destruction of these wastes.

2.1.2.1 Land Based Incinerators. Four studies have been conducted in the U. S. with data from 10 land based incinerators.[13,14,15,16] In tests on two rotary kilns incinerating polychlorinated biphenyl (PCB's), TCDD emissions were low (ND-2.48 ng/m^3).[13] These incinerators were equipped with afterburners (1200°C). In both bases, the addition of supplemental fuel resulted in no PCDD's detected. Tests on a controlled air incinerator firing polychlorinated phenol treated wood also showed no PCDD's detected.[17] This incinerator was also equipped with an afterburner (1370°C) and used supplemental fuel.

2.1.2.2 Incinerator Ships. Two studies were conducted with the Vulcanus incinerator ship.[8,9] The first study was conducted during the incineration of Herbicide Orange. TCDD levels in the feed ranged from ND-2.4 µg/g. No PCDD's were detected in the stack emissions. The second study was conducted during a PCB burn. PCDD's were not found in the feed or stack emissions. However, PCDF's were found in the feed. This incinerator ship uses a dual chamber configuration. Furnace temperatures reach 1600°C with a residence time of 1.35 seconds.

2.1.2.3 Boilers Cofiring Wastes. A review of the literature has produced five studies describing dioxin emissions from 13 boilers cofiring wastes. The Industrial Environmental Research Laboratory (IERL) in Cincinnati conducted studies on eight industrial boilers cofiring waste products.[20] Four boilers were cofiring chlorinated wastes and were tested for dioxin. A steam boiler firing waste wood contaminated with pentachlorophenol (PCP) and PCDD's emitted TCDD's at a level of 38-43 ng/m^3. PCDD's in the feed were highly chlorinated isomers. PCDD's formed from PCP should also be highly chlorinated isomers.[21] The predominance of TCDD's in stack emissions indicates that dechlorination had occurred. Further analysis of the results indicate that the lower chlorinated isomers (TCDD's) escape with the small particulates and flue gas, while the higher chlorinated isomers are trapped with large particulates in the electrostatic precipitator (ESP). The three boilers remaining were tested for PCDD's at a detection limit of 1,000 ng/m^3. No PCDD's were detected. At present, more sensitive tests are being conducted on archived samples from these three boilers.

Two unrelated studies detected dioxins in ash samples from boilers cofiring PCP wastes.[22,23] In one study, stack emissions were tested.[22] No PCDD's were detected. However, the detection limits were high (10 μg/m^3). A final study found no PCDD's or PCDF's in the emissions of a high efficiency industrial boiler firing PCB contaminated oil.[24] The detection limits in this study were again high.

Dow Chemical tested two industrial waste incinerators; a 72 million Btu/hour stationary tar burner and a 70 million Btu/hour rotary kiln.[25] In both cases, PCDD's were detected in the fly ash taken from the stacks. When supplemental fuel was added to the rotary kiln, no TCDD's were detected at a 2.0 ppb detection limit.

2.1.2.4 Lime/Cement Kilns Cofiring Wastes. One study has addressed PCDD emissions from cement kilns cofiring wastes.[26] This study tested emissions from the San Juan cement kiln while cofiring pharmaceutical wastes (21 percent Cl). No PCDD's or PCDF's were detected at a detection limit of 14.9 ng/m^3. The combustion temperature of this process is 1260°C, with a residence time of 1.5 seconds. The State of California is planning to test a dry cement kiln cofiring wastes. Details on this study are not yet available.

2.1.3 Sewage Sludge Incineration

Very little data is available on PCDD emissions from sewage sludge incinerators. A Canadian study detected PCDD and PCDF emissions from a sewage sludge incinerator at concentrations of 0.739 μg/m^3 and 1.213 μg/m^3, respectively.[27] The incinerator was a multiple hearth unit with a combustion temperature of 1000°C. Currently, there are no U. S. studies available. However, the New Bedford Incinerator in Massachusetts has been tested. The results will be available before the Tier 4 final report is completed.

2.1.4 Coal Boilers

The EPA conducted a national survey of organic emissions, including PCDD's and PCDF's, from coal fired utility boilers.[8] Seven large utility boilers were tested. No PCDD's were detected in the emissions. The boilers were large pulverized coal units operating at temperatures above 1000°C. Several smaller studies recorded similar results.[28,29,30] The only study that detected PCDD's in coal fired boilers was a Dow Chemical Study.[25] TCDD's were detected in the fly ash at a level of 38 ppb. In an experimental study, Dow Chemical detected PCDD emissions from coal combustion but only when chlorine was added to the feed.[31] A small spreader stoker coal boiler will be tested in the near future by IERL. This test may include dioxin analysis.

2.1.5 Activated Carbon Regeneration

The regeneration of activated carbon has been studied in Cincinnati, Ohio.[32] This carbon serviced the Cincinnati water supply for approximately 1 year. PCB's were detected in the feed. Parts per trillion (ppt) levels of TCDD were detected in the fly ash and flue gas samples. This facility operated a rotary kiln at 800°C. The air supply was limited to prevent combustion of the carbon.

2.1.6 Wire Reclamation

One PCDD study has been conducted on a wire reclamation incinerator.[33] TCDD and tetrachlorodibenzofuran (TCDF) concentrations in ash scrapings were 410 ppt and 11,600 ppt, respectively. Wire insulation incinerated during this process often contains PCB's and polyvinyl chloride. To prevent oxidation of the copper wire, both combustion temperatures and oxygen levels are kept low.

2.1.7 PCB Transformer Fires

Ash samples from two PCB fires have been analyzed for PCDD's.[34,35] In both cases, PCDD's were detected at elevated levels. At a third fire, PCDF's were detected in both the uncombusted PCB oil and ash samples.[36] In experimental work, Buser *et al* demonstrates the formation of PCDF's by pyrolysis of PCB's.[55] Buser postulates an intramolecular cyclization mechanism.

2.1.8 Residential Wood Combustion

Dow Chemical conducted two series of tests on wood stoves.[25,38] The levels of TCDD's detected in ash samples ranged from ND-370 ppt. The feed material was untreated wood and residential wastes. While untreated wood has a low chlorine content, the addition of residential wastes (plastics) provides the chlorine necessary for PCDD formation. Both combustion temperature and local oxygen availability are expected to be low.

2.1.9 Mobile Sources

Two series of tests have been conducted on auto emissions.[25,39] In a test series by Dow Chemical, TCDD levels in muffler scrapings ranged from ND to 20 ppt. This test series included regular and unleaded cars and diesel trucks. Currently, the Environmental Science Research Laboratory in Research Triangle Park is conducting limited emissions tests for dioxin from gasoline and diesel trucks. This work will be available in the Tier 4 final report.

2.1.10 Experimental Studies

Extensive experimental studies have been conducted on PCDD and PCDF formation from combustion of chlorinated aromatics. Three categories of organics have been tested: PCB's, chlorobenzenes, and chlorophenols. The effect of inorganic chlorine on PCDD emissions has also been studied.

The major focus of the experimental work identified is the formation of PCDD's from the combustion of chlorinated phenols. Experiments by Rappe[40], Jansson[37], and Ahling[41,42] demonstrate the formation of PCDD's at combustion temperatures of 500-800°C. Above this temperature, PCDD's are believed to be mostly destroyed. Formation mechanisms postulated are (1) dimerization of chlorophenates, (2) cyclization of predioxin, and (3) dechlorination of higher chlorinated dioxins.

Buser investigated the formation of PCDD's and PCDF's from the pyrolysis of chlorobenzenes.[43] Both PCDD's and PCDF's were detected in pyrolyzed samples. The formation mechanism proposed included a chlorophenol intermediate.

Buser also investigated the formation of PCDF's from the pyrolysis of PCB's.[44,45,46] The yields of PCDF's were estimated to range from 0.1 percent to several percent. The proposed formation mechanism is an intramolecular cyclization. No experimental work has been identified on PCDD formation from PCB's. However, PCDD formation from PCB combustion has been demonstrated in two transformer fires.[34,47] Elevated levels of PCDD's were found in ash samples from both fires. During two series of PCB destruction tests, PCDD emissions from rotary kilns increased when PCB wastes were added to the feed.[13]

Three recent reports have dealt with PCDD formation from combustion processes in the presence of inorganic chlorine.[31,48,49] Tiernan found no detectable PCDD's or PCDF's emitted from the combustion of virgin pine.[48] However, in the presence of HCl, significant quantities of TCDD's were detected. Mahle presents similar results when burning coal in the presence of Cl_2, HCl, and NaCl.[31] Liberati studied the combustion of vegetables.[49] When inorganic chlorine or polyvinly chloride (PVC) is added, PCDD's and PCDF's were detected in the emissions.

2.2 POSSIBLE, PLANNED, OR ONGOING WORK

Table 2-3 lists PCDD studies that are either ongoing or being considered. Results from many of these tests will be available in the Tier 4 final report.

The IERL in Cincinnati, Ohio is conducting a series of tests. These include a steel blast furnace cofiring hazardous wastes in Pennsylvania and a spreader stoker coal boiler cofiring hazardous wastes.

One sewage sludge incinerator is listed. The New Bedford incinerator has recently been tested. Results are due in the near future.

Several regions have expressed interest in testing MWC's. Several studies are planned outside of Tier 4 including the retesting of the Hampton NASA Incinerator, tests on five incinerators by the State of New York, and a possible detailed analysis of an incinerator by the American Society of Mechanical Engineers (ASME).

Two important foreign studies are currently ongoing. The University of Waterloo in Canada is conducting a study on a Paris MWC. This study is attempting to correlate operating conditions with levels of PCDD emissions.

TABLE 2-3. POSSIBLE, PLANNED, OR ONGOING WORK (AS OF NOVEMBER 1984)

Organization	Source Type	Number of Tests
DOE	Coal/Waste Boiler	1
EPA, ORD	Stoker Coal Boiler	1
EPA Regional Offices	Municipal Waste Incinerator	1
State Offices	Municipal Waste Incinerators	6
	Dry Cement Kiln (with HW)	1
	Acid Recovery Plant	1
NASA	Municipal Waste Incinerator	1
Environment, Canada	Municipal Waste Incinerators	3

A current Japanese study, funded by (California Air Resources Board (CARB), is looking at the effect of control devices on PCDD emissions. No information is currently available concerning the types of control devices used.

2.3 SUMMARY AND PURPOSE OF LITERATURE REVIEW

The literature review has produced a list of 12 source categories that have been tested for PCDD's. Ten of the 12 source categories tested have been shown to emit PCDD's at detectable levels. Likewise, theories proposed for PCDD formation mechanisms and experimental studies that support these theories have been identified. By evaluating the proposed formation mechanisms and characteristics of the tested sources, a list of factors that may affect PCDD emissions have been developed. Based on these factors, source categories with suitable operational and fuel characteristics are identified for the Tier 4 testing program. The next section presents a more detailed discussion of the factors that are believed to affect PCDD emissions.

3.0 FACTORS AFFECTING DIOXIN EMISSIONS

There are several unproven hypotheses concerning PCDD emissions from combustion processes. Dow Chemical's "Chemistries of Fire" theory proposes that PCDD's are a natural byproduct of fire and will be formed at some quantities in all combustion processes.[25] However, experimental results by Buser and Rappe and an evaluation of data from the literature suggests that PCDD's are emitted only under limited conditions. The most prevalent theories, including Esposito's formation mechanism, involve the incomplete combustion of PCDD's or PCDD precursors. Although there is some disagreement on the definition of precursors, PCDD precursors are defined in this paper as chlorinated aromatics that can produce PCDD's through bimolecular reactions and thermal rearrangements. Examples include chlorinated phenols and chlorinated benzenes. When PCDD's are in the feed of a combustion source, they can escape with the fine particulate if thermal destruction efficiency is low. Additionally, PCDD precursors may be thermally rearranged during incomplete combustion to form PCDD's.

Neither the Dow hypothesis nor the precursor hypothesis have been conclusively supported or refuted. Recent studies involving pyrolysis of wood with and without chlorination, in conjunction with the studies of pyrolysis of chlorinated coal, suggest that inorganic chlorine at high levels with any organic material may very well lead to PCDD formation under certain conditions (see Section 2.1.10).

This section discusses the various factors identified in the literature that may effect PCDD emissions. These are listed below.

Based on the literature review, the following factors are believed to affect dioxin emissions:

- PCDD in feed,
- Precursors in feed,
- Chlorine in feed,
- Combustion temperature,
- Residence time,
- Oxygen availability,

- Feed processing, and
- Supplemental fuel.

How these factors interact during the formation of PCDD's is not well defined. Therefore, each of the factors will be discussed separately below. Once the results of the source test program and ash screening studies are available and have been analyzed, an assessment of the relative importance of each of these factors can be made. In addition, now Dow's hypothesis and the precursor hypothesis can be tested with the additional information.

3.1 PCDD IN FEED

2,3,7,8-TCDD is an impurity that results from the manufacture of trichlorophenol, which is used to make the herbicide 2,4,5-trichlorophenoxy acetic acid (245-T). Pentachlorophenol (PCP) production will also result in a PCDD contaminant, primarily octachlorodibenzo-p-dioxin (OCDD). The primary end use for PCP is as a wood preservative. It is anticipated that limited PCDD contamination will also occur during the manufacturing of other similar chlorinated aromatics, particularly if the manufacturing process is inefficient or not well controlled. Therefore, PCDD's are expected to enter the environment as a contaminant of commercial products, such as wood preservatives and pesticides.

The widespread use of these products increases the possibility of finding PCDD's in the feed of a combustion process. For example, PCP treated wood may be used to fire boilers. Runoff may carry pesticides to water treatment facilities where the organics are incorporated into a sludge. The sludge may then be incinerated. Likewise, contaminated waste streams from manufacturing processes may be incinerated as an energy recovery procedure. Two examples are PCP sludge incinerators used at wood preserving facilities and black liquor recovery boilers used at paper mills.

The IERL industrial boiler study discussed in Section 2.1.2.3 demonstrates that PCDD's have been detected in combustion source emissions with PCDD's in the feed.[20] If PCDD's are found in the feed of an inefficient or poorly controlled combustion process, it is very likely that they will be released to the atmosphere.

3.2 PRECURSORS IN FEED

Although the Dow "Chemistry of Fire" theory is backed by a considerable amount of experimental data, much of the experiments reviewed focused on the formation of PCDD's and PCDF's from precursors. Experiments by Buser, Rappe, and others are described in more detail in Section 2.1.10. Esposito et al presented detailed descriptions of the formation mechanisms of chlorinated dioxins from precursors.[50] This work organizes dioxin precursors into three classes:

Class I - Polyhalogenated phenols, primarily with a halogen ortho to the hydroxyl group, with a high probability of dioxin formation.

Class II- Ortho-halophenols and ortho-halophenyl esters where the substituted groups are a mixture of halogens and nonhalogens.

Class III - Other chemicals having the possibility, but less likelihood, of dioxin formation. These include chlorinated aromatic compounds.

The majority of experimental work to date has centered on three classes of precursors: chlorinated phenols, chlorinated benzenes, and PCB's. Table 3-1 lists the uses and annual production rates for these three classes of chemicals.

PCDD formation from the combustion of chlorinated phenols has been tested extensively by Rappe[40], Jansson[37], and Ahling[41,42]. The formation of 2,3,7,8-TCDD from 2,4,5-trichlorophenol is illustrated in Figure 3-1a. Figure 3-1b illustrates the formation of OCDD from PCP. Dechlorination of the highly chlorinated homologs can result in the more toxic TCDD isomers.

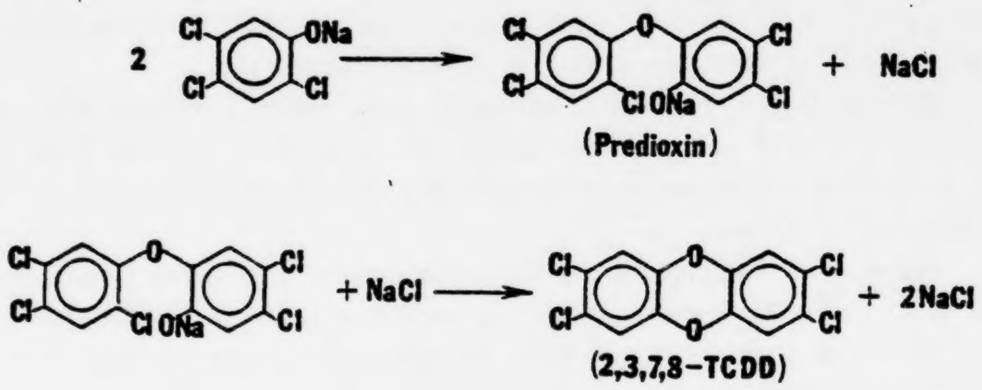
Chlorinated phenols are used as wood preservatives, herbicides, and sap stain control. Wood or vegetation sprayed with chlorophenols may be disposed of by incineration or used as a supplemental fuel in boilers. In addition, chlorophenol wastes are often disposed of in sludge incinerators and industrial boilers. The identified experimental references indicate that these combustion sources should be considered in the Tier 4 testing program.

Buser investigated the formation of PCDD's and PCDF's from the pyrolysis of chlorobenzenes.[43] The formation mechanism included a

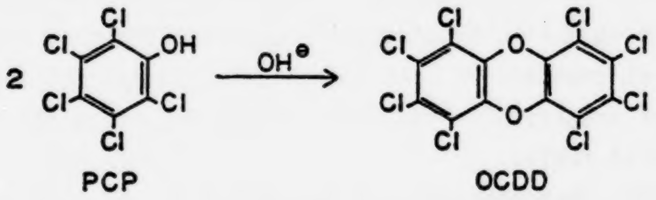
TABLE 3-1. PCDD PRECURSORS

Precursor	Use	Quantity
Chlorophenols	Herbicides Fungicides Wood Preservatives Sap Stain Control	6.30×10^7 kg/yr
Chlorobenzenes	Manufacturing Intermediates Inert Solvents Rubber Production Pesticides Lubricants Pharmaceuticals Dyes Wood Preservatives	2.15×10^8 kg/yr
PCBs	Transformers Capacitators Insulation Hydraulic Fluid Plasticizers Dyes	5.7×10^{11} kg/yr (1930-1975)

Source: Reference No. 50.


2
Cl
ONa
Cl
Cl
Cl
ONa
Cl
Cl
Cl
Cl
+ NaCl
(Predioxin)
+ NaCl
(2,3,7,8-TCDD)
+ 2NaCl

A: 2378-TCDD Formation from 245-trichlorophenol


2
Cl
OH
OH⁻
PCP
OCDD

B: OCDD Formation from PCP

Figure 3-1. PCDD formation from chlorophenols.

chlorophenol and a polychlorinated diphenyl ester (PCDPE) intermediate. Figure 3-2 illustrates the possible formation mechanisms.

Chlorobenzenes are used in solvents, dyes, pharmaceuticals, and rubber production. These products make up much of the organic chlorine found in MWC feed. The associated waste product may also be disposed of in an incinerator or boiler.

Buser also investigated the formation of PCDF's from the pyrolysis of PCB's.[43,44,45] The proposed formation mechanism is an intramolecular cyclization as shown in Figure 3-3. No experimental work has been identified on PCDD formation from PCB's. However, several studies have been identified that found PCDD's emitted from PCB fires.[13,34,47] In addition, PCB's are often in solution with hexachlorobenzenes that have been shown to form PCDD's.

Up until 1975, PCB's were used as dielectric fluids in transformers and capacitors. PCB's have also been used in hydraulic fluids, plasticizers, and dyes. The incineration of PCB's at waste disposal facilities or in boilers may result in PCDD and PCDF emissions.

3.3 CHLORINE IN FEED

The chlorine content of fuel is obviously an important parameter affecting the formation of PCDD's or PCDF's. Shih et al developed a ranked priority list of conventional combustion systems emitting polycyclic organic matter including PCDD's and PCDF's.[51] The rationale presented for source ranking is based on fuel characteristics and combustion conditions. Shih's work places great emphasis on both the chlorine content of the feed and the concentration of aromatics in the feed. Table 3-2 lists the chlorine content of several fuels.

Other authors have demonstrated the effect of chlorine on dioxin emissions. Mahle et al demonstrated that PCDD's were emitted from coal combustion only when chlorine was added.[31] Tiernan et al found PCDD formation during the combustion of pine in the presence of HCl, but no PCDD's were detected during the combustion of pine alone.[48] Liberti

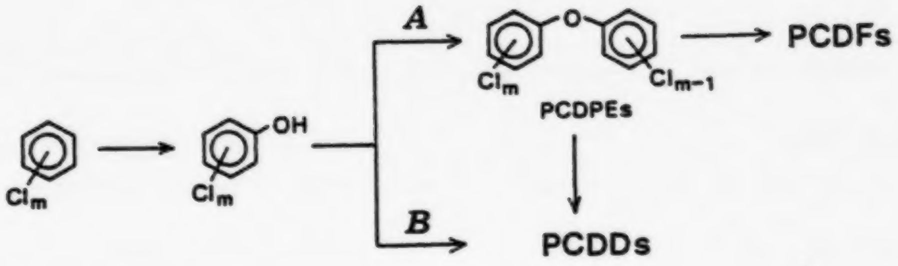

A
B
Cl_m
OH
Cl_{m-1}
PCDPEs
PCDFs
PCDDs

Figure 3-2. PCDD and PCDF formation from chlorobenzenes[17]

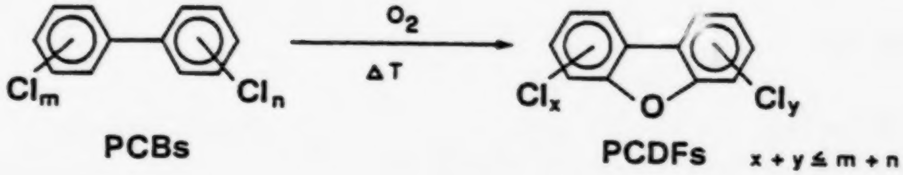

O_2
ΔT
Cl_m
Cl_n
Cl_x
Cl_y
O
PCBs
PCDFs
$x + y \leq m + n$

Figure 3-3. PCDF formation from PCB's[20]

TABLE 3-2. FUEL CHLORINE CONTENT

Fuel Type	Chlorine Content (ppm)
Refuse Derived Fuel	1,400 - 9,500
Paper	300 - 1,600
Wood	11 - 84
Coal	10 - 3,700
Residual Oil	1 - 200
Crude Oil	1.6 - 74
Distillate Oil	50 - 100
Natural Gas	---
PCP/PCB Wastes	Several Percent

Source: Reference No. 51

studied the combustion of vegetables.[49] When inorganic chlorine or PVC is added, PCDD's and PCDF's were detected in the ash.

While the precursor theory has received widespread acceptance, these inorganic chlorine studies demonstrate that the specific mechanisms involved in PCDD formation are complex and not well understood. However, it can be generally stated that chlorine must be present for the formation of PCDD, and general trends indicate that increased chlorine concentrations in the feed improve the possibilities of PCDD emissions.

3.4 COMBUSTION CONDITIONS

The remaining factors that affect PCDD emissions are combustion conditions. These are combustion temperature, residence time, supplemental fuel, fuel processing, and oxygen availability. The combustion efficiency is a function of all of these factors. In order to destroy PCDD's or prevent their formation, the combustion efficiency must be high. This requires a combination of high temperatures, available oxygen, high Btu fuel, and long residence times. Each factor is discussed separately below.

3.4.1 Combustion Temperature

Experimental evidence suggests that temperatures of 500-800°C promote PCDD formation, while temperatures greater than 800°C destroy PCDD's.[41,46,25] Buser et al showed that PCB pyrolysis at 550-650°C forms PCDF.[47] However, pyrolysis at temperature greater than 700°C causes 99 percent destruction of PCB's and no PCDF formation. Ahling et al produced similar results for both PCDD's and PCDF's during the combustion of chlorophenols.

Combustion temperature is a function of the Btu content of the fuel or supplemental fuel, the available air, and the degree of fuel processing. MWC's are considered a major combustion source of PCDD's.[10] The large mass burn units are characterized by low combustion temperatures. This is due in part to the high moisture, low Btu fuel, poor air/feed mixing as a result of a lack of feed processing, and lack of supplemental fuel. In comparison, many hazardous waste incinerators and high efficiency boilers are designed for efficient combustion. These units burn high Btu fuels or add high Btu supplemental fuels and, even if the air/fuel ratio is low, the air/fuel mixing is efficient. The fuels are processed to decrease moisture and improve mixing. In many cases, high temperature afterburners are used for the combustion of offgases. Several studies have been identified that demonstrate the effects of high combustion temperatures on PCDD's and PCDD precursors.[13,19,26] For example, no PCDD's were detected in the emissions of the Vulcanus incinerator ship during the combustion of PCDD contaminated Herbicide Orange.[19] The combustion temperature during this project was 1600°C.

When selecting sources for the Tier 4 testing program, combustion temperatures will be considered. Source categories characterized by low combustion temperatures are considered potential sources of PCDD emissions.

3.4.2 Residence Time

The residence time necessary to destroy PCDD's and the combustion temperature are inversely related. The higher the combustion temperature, the shorter the required residence time for PCDD destruction. Likewise, a low temperature source will require a long residence time for destruction of PCDD's. Sachdev et al showed that an increase in both temperature and residence time decreased the formation of PCDD's from chlorophenol combustion.[52] Similar results have been found at hazardous waste incinerators that run with 1.5-2.0 second residence times. Combustion sources with longer residence times and high temperatures are less likely to form products of incomplete combustion, such as PCDD's.

3.4.3 Oxygen Availability

Oxygen availability is a function of both the air/fuel ratio and air/fuel mixing efficiency, both of which are of concern when burning solid fuels. Solid fuels and high viscosity liquid fuels (waste tars, etc.) burn as particulates or large droplets; and, therefore, portions of the fuel are burned in low oxygen or pyrolysis conditions. An insufficient supply of oxygen or poor air/fuel mixing will promote poor combustion conditions and the formation of PCDD's. Jansson demonstrates that an insufficient air supply increases PCDD emissions from chlorophenol combustion.[37] MWC's are usually fired with excess air. However, large mass burn units have poor air/fuel mixing due to the lack of fuel processing. Activated carbon regeneration and wire reclamation incinerators are both designed with limited air. All of these cases have been shown to emit dioxins.[9,32,33] Available oxygen will be considered during the source ranking. Sources with a low air/fuel ratio or poor air/fuel mixing will be considered potential sources of PCDD emissions.

3.4.4 Feed Processing

The feed material for a combustion source may be a liquid, a solid, or a gas. Both liquid and gas fuels can be easily mixed with air resulting in a high combustion efficiency; solid feeds usually require some processing to improve combustion. Often solid feeds require drying, shredding, or separation to improve combustion. Similarly, high viscosity fuels (i.e., waste tars) require preparations such as preheating and atomization prior to combustion.

Feed processing will determine in part both oxygen availability and residence time. Fine, homogeneous feed particles will improve air/fuel mixing and combustion. Larger particles will require longer residence times and may result in local oxygen deficiencies due to poor mixing. High moisture will also decrease combustion efficiency. Therefore, highly processed homogeneous feeds are less likely to emit products of incomplete combustion, such as PCDD's.

3.4.5 Supplemental Fuel

When burning a low Btu fuel, the addition of supplemental fuel will increase the combustion temperature and improve combustion. Haile *et al* tested a boiler cofiring RDF with coal.[11] The boiler temperature was 1200°C, and no PCDD's were detected. Dow Chemical tested an industrial incinerator burning waste tars without supplemental fuel and found ppb levels of TCDD's in the fly ash.[25] After the addition of a supplemental fuel, no TCDD's were detected.

When selecting sources for the Tier 4 testing program, sources fired with high Btu supplemental fuel will be considered less likely to emit PCDD's. Sources burning low Btu wastes without supplemental fuels are likely candidates for testing.

4.0 DEVELOPMENT OF THE RANKED SOURCE LIST

Based on the results of the literature review, a sampling plan has been developed that will provide data to allow a better definition of the nature of the dioxin emissions problem. Due to Tier 4 budget constraints, not all source categories identified by the literature search will be tested. In order to facilitate the source selection process, source categories must first be ranked based on factors identified in Sections 2.0 and 3.0. Source categories with the highest ranking will be stack tested first, and source categories ranked with a low potential to emit dioxins will be screened early in the test program. Source screening will involve collecting ash samples and analyzing these samples for PCDD's. Screening results will help select which of the lower ranked categories should be stack tested and will help characterize source categories that will not be stack tested. The following chapter describes the rationale used to select and rank broad source categories for the Tier 4 testing program.

During the development of the ranked source list, very broad source category definitions were used. All of the source categories can be subdivided further and, in many instances, it is anticipated that some subcategories will have a higher potential for PCDD emissions than others. For example, municipal waste combustion can occur in large field erected units designed for energy recovery or in smaller package units. The waste can be burned as is or can be classified in a number of ways including by air or by wet processing. In addition, refuse derived fuel can be cofired in boilers. As discussed earlier, each of these differences in subcategories can affect dioxin emissions. Due to the limited amount of information available and the subjective nature of the ranking process, the authors felt that subcategorization was not justified for the development of the preliminary source list.

As site selection for ash screening and stack testing proceeds, consideration should be given to the representativeness of the facilities selected. Subcategories of the major categories may well be justified especially during ash screening.

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4.1 DEVELOPMENT OF PRELIMINARY SOURCE LIST

The first step in the ranking process is to develop a fairly extensive list of the major combustion source categories. Table 4-1 lists the approximately 50 combustion sources considered. The sources listed can be categorized in one of the following groups:

(1) Fossil fuel boilers, process heaters, oil engines;
(2) Manufacturing processes;
(3) Waste disposal; and
(4) Accidental fires.

Source category size and precursor concentration in the feed are key criteria in the selection of these categories. Based on precursor content described by Esposito[50] and chlorine content, many waste disposal categories and manufacturing processes were selected. A review of AP-42 and the 1981 NED's Fuel Use Report suggested several fossil fuel and wood fired source categories. These sources were selected based on size and emissions data.

From this list of potential source categories, a preliminary source list has been developed. These sources are most likely to pose a dioxin emissions problem. Source categories on the preliminary source list will eventually be ranked and considered for stack testing. Selection of source categories for the preliminary source list is based on the following criteria:

(1) PCDD's detected in previous studies;
(2) Elevated levels of chlorine, PCDD precursors, or PCDD's in feed;
(3) Experimental studies that suggest the source is a potential PCDD emitter; and
(4) Favorable combustion conditions for PCDD formation based on operational parameters described in Section 2.0.

For example, wood stoves have been shown to produce dioxins.[25] Based on this work and the possibility of PCP contamination, wood fired boilers and wood stoves warrant further research. Municipal waste combustors, sewage sludge incinerators, and hazardous waste incinerators have all been previously tested, and PCDD's were detected. Precursor and chlorine levels in the feed indicate that both black liquor boilers and other waste fired

TABLE 4-1. COMBUSTION SOURCES

Fossil Fuel Boilers, Process Heaters, or Engines

- Boilers
  - Coal Fired
  - Oil Fired
  - Natural Gas Fired
  - Liquified Petroleum Gas
  - Wood Fired
- Process Heaters
  - Oil
  - Natural Gas
  - Refinery Gas
- Turbines
  - Oil
  - Natural Gas
- Internal Combustion Engines
  - Stationary
  - Mobile
- Home Heating
  - Oil
  - Natural gas
  - Coal
  - Wood stoves/fireplaces

Industrial Processes

Catalytic Cracking
Charcoal Manufacturing
Carbon Black Manufacturing
Coke Manufacturing
Coal Gasification
Asphalt Manufacturing
Coffee Roasting
Meat Smoke Houses
Black Liquor Recovery Boilers (Kraft paper mills)

Waste Disposal Operations

- Bagasse Boilers
- Wood Waste Boilers
- Refuse Derived Fuel Boilers
- Municipal Waste Incinerators
- Hazardous Waste Incinerators
  - land based
  - incinerator ship
- Sewage Sludge Incinerators
- Waste Oil Boilers
- Cement/Lime Kilns (Waste Fired)
- Wire Reclamation Incinerators
- Carbon Reactivation
- Hospital Incinerators
- Open Burning
- Agricultural Burning

Accidental Fires

Electrical Transformers
Structural Fires
Forest Fires
Subway Fires

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boilers should be considered. Based on combustion conditions, activated carbon regeneration, charcoal manufacturing, and wire reclamation will also be considered. In each of these processes, both the combustion temperature and the air/fuel ratio are limited by design.[53,54,55]

Some source categories will be excluded from the preliminary list. Based on an evaluation of available data, these source categories are not expected to present a significant health risk. Therefore, these source categories will not be considered for stack testing during the initial ranking procedure. At the request of State or regional offices, these sources and others not listed will be screened using ash samples. Exclusion of source categories from consideration for stack testing was based on the following criteria:

(1) Low chlorine fuel (natural gas, clear oil);
(2) Low precursor level (less than 1 ppm);
(3) Small source category (low annual tonnage); and
(4) Intermittent source category.

Based on previous studies and chlorine content, fossil fuel boilers, process heaters, and turbines have been excluded from the preliminary list.[44] In addition, processes using clean fossil fuels, such as carbon black manufacturing and coal gasification, have been excluded. Two exceptions are small spreader stoker coal boilers and mobile sources. Due to combustion conditions (poor air/fuel mixing and lower temperatures), small spreader stoker coal boilers will be included in the test plan. Dioxins have been detected in two previous studies on mobile sources.[25,39]

Sources burning low annual tonnages such as coffee roasting, meat smoke houses, or open burning have also been excluded from the preliminary list. Similarly, intermittent sources such as accidental fires or incinerator ships have been excluded. While on an individual basis, many of these sources may emit dioxins, these source categories do not pose the potential exposure problem that would be expected with large continuous sources. Table 4-2 lists the major exclusions from the preliminary source list.

Table 4-3 presents the preliminary list of combustion source categories and rationale for selection. In the next section, the rationale for ranking the preliminary source list will be presented.

TABLE 4-2. COMBUSTION SOURCE CATEGORIES EXCLUDED FROM PRELIMINARY SOURCE LIST

- Coal: Tested extensively by EPA
  No PCDD detected

- Natural Gas: Clean burning
  Low chlorine

- Clean oil: Low chlorine

- Processes using low chlorine petroleum products

  - Carbon Black Manufacturing
  - Catalytic Cracking
  - Coke Manufacturing
  - Coal Gasification
  - Asphalt Manufacturing

- Intermittent Sources/Low National Fuel/Feed Use

  - Incineration Ships
  - Coffee Roasting
  - Meat Smoke Houses
  - Bagasse Boilers
  - Open Refuse Burning
  - Most Accidental Fires

TABLE 4-3. COMBUSTION SOURCE CATEGORIES BELIEVED TO HAVE THE GREATEST POTENTIAL TO EMIT DIOXINS

Source	Rationale
Hazardous Waste Incinerators	TCDD[1] Detected
Municipal Waste Incinerators	TCDD Detected
RDF[2] Boilers	TCDD Detected
Commercial Waste Oil Boilers	TCDD Detected
Industrial Boilers Cofiring Wastes	TCDD Detected
Wire Reclamation Incinerators	TCDD Detected
Activated Carbon Regeneration	TCDD Detected
PCP[3] Sludge Incinerators	TCDD Detected
Sewage Sludge Incinerators	PCDD[4] Detected
Mobile Sources	TCDD Detected
Wood Stoves/Fireplaces	TCDD Detected
Wood/Bark Boilers	Experimental results with PCP treated wood
Charcoal Manufacturing	Experimental results with PCP treated wood, combustion conditions
Black Liquor Boilers	Elevated POM's in effluent
Cement/Lime Kilns Cofiring Wastes	Precursors present
Small Spreader-Stoker Coal Boilers	Favorable combustion conditions for dioxin formation
Hospital Incinerators	Burn plastics, equipped with low stacks and are located in urban areas
Agricultural Burning	Areas where chlorinated pesticides have been applied

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[1] TCDD refers to the tetra homologues as a group. Available analyses are mixed, with some researches reporting "total tetras" and others reporting 2,3,7,8-TCDD or both. The presence of TCDD's generally indicates some likelihood of 2,3,7,8-TCDD being present.

[2] RDF = Refuse Derived Fuel.

[3] PCP = Pentachlorophenol.

[4] PCDD = Total of all dioxin homologues or polychlorinated dibenzo dioxins. While detection of PCDD's does not necessarily indicate presence of TCDD or 2,3,7,8-TCDD, there are sufficient data to infer such in this case.

[5] PCB = Polychlorinated biphenyls.

4.2 DEVELOPMENT OF RANKING CRITERIA AND THE RANKED SOURCE LIST

Shih et al developed a ranked priority list of conventional combustion systems emitting polycyclic organic matter.[51] The emphasis of this work was on PCDD's, PCDF's, and PCB's. The rationale presented for source ranking was based on fuel characteristics and combustion process characteristics. Table 4-4 presents Shih's ranked list.

Radian's efforts to rank combustion sources with the potential to emit TCDD is based on Shih's work, with the following exceptions:

(1) A greater emphasis is placed on combustion of wastes as fuels and on dioxin precursors in the feed.

(2) Coverage has been expanded to include nonconventional combustion sources, such as waste fired boilers and black liquor boilers, which are considered due to the potential for elevated concentrations of chlorinated aromatics in the feed.

(2) Source category size (annual tonnage) is considered during ranking.

(3) The number of valid tests previously conducted on a source category is also considered a ranking criteria.

The following discussion presents supporting data, ranking rationale, and key references used during the development of the ranked source list. Figure 4-1 summarizes these procedures by means of a flow chart. Source categories from the preliminary source list are ranked into one of four groups. Rank descriptions are listed in Table 4-5.

The ranking process was highly subjective since no realistic assignment of weighing factors could be made for each of the ranking criteria. The development of a ranked list would change depending on the relative importance given to the ranking criteria. The criteria used to rank the preliminary source list are based on factors affecting dioxin emissions identified in the literature review. In addition, the size of the source category, the location of the sources, and the results of previous tests are considered. Table 4-6 lists the ranking criteria. Table 4-7 summarizes source characteristics used in the ranking procedure.

TABLE 4-4. SHIH'S RANKED PRIORITY LIST OF COMBUSTION SYSTEMS FOR SOURCE TESTING[51]

Priority List for Chlorinated POM Compounds*	Corresponding Priority Ranking for Brominated POM Compounds+	Corresponding Priority Ranking for PAH Compounds
1. Coal-refuse spreader stoker	1	10
2. Municipal refuse incineration	2	12
3. Coal-refuse suspension-firing	3	16
4. Wood combustion - dutch oven	4	7
5. Wood combustion - overfeed stoker	5	8
6. Wood combustion - spreader stoker	7	11
7. Waste oil combustion	6	19
8. Bituminous coal - hand-fired units	8	1
9. Bituminous coal - overfeed stoker	9	3
9. Bituminous coal - underfeed stoker	9	3
11. Bituminous coal - spreader stoker	11	5
12. Wood combustion - hand-fired units	13	2
13. Lignite - other stokers	12	6
14. Lignite - spreader stoker	14	9
15. Bituminous coal - cyclone	15	13
16. Bituminous coal - pulverized dry-bottom	16	14
17. Bituminous coal - pulverized wet-bottom	17	16
18. Lignite - cyclone	18	18
19. Lignite - pulverized dry-bottom	19	19
20. Distillate oil - home heating units	20	15
21. Residual oil - packaged boilers	21	21
22. Residual oil - field-erected boilers	22	22
23. Distillate oil - packaged boilers	23	23

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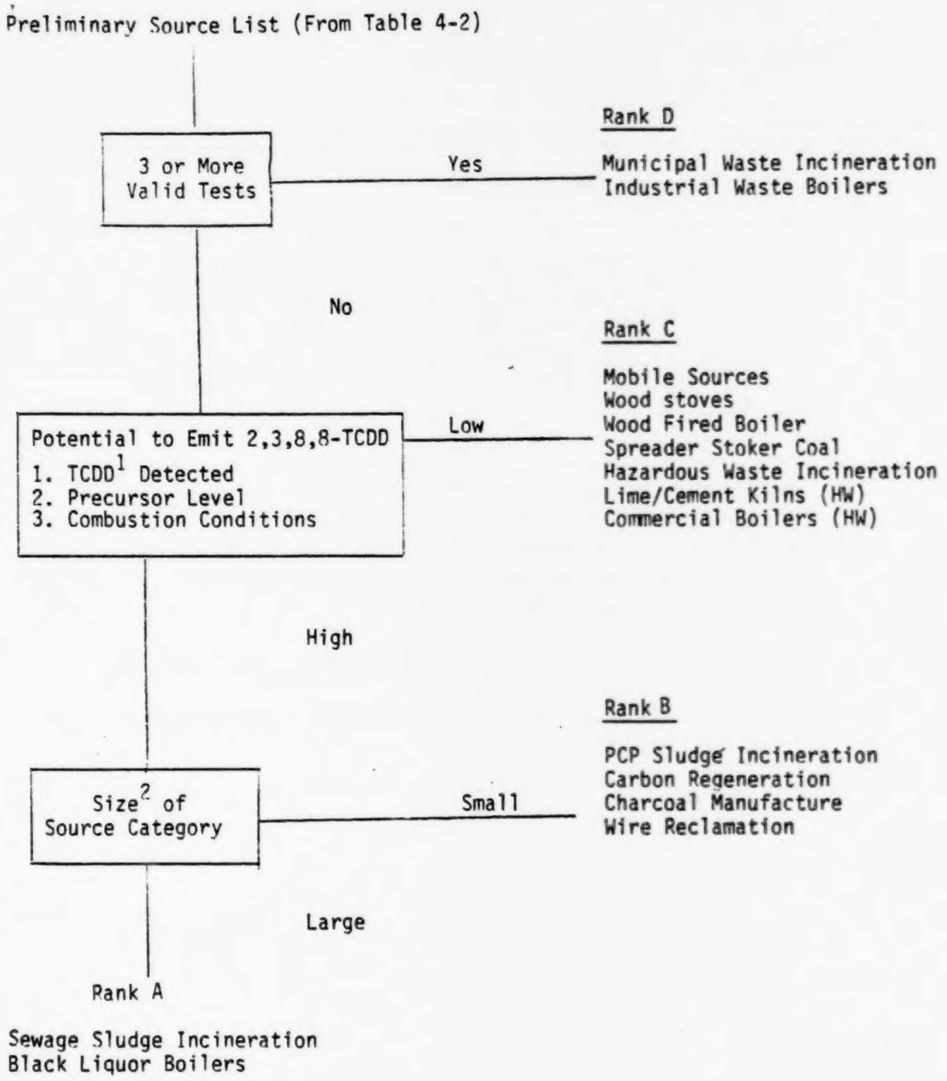
* Chlorinated POM compounds include PCDDs, PCDFs, and PCBs.

+ Brominated POM compounds include PBDDs, PBDFs, and PBBs.


Preliminary Source List (From Table 4-2)
3 or More Valid Tests
Yes
Rank D
Municipal Waste Incineration
Industrial Waste Boilers
No
Rank C
Mobile Sources
Wood stoves
Wood Fired Boiler
Spreader Stoker Coal
Hazardous Waste Incineration
Lime/Cement Kilns (HW)
Commercial Boilers (HW)
Potential to Emit 2,3,8,8-TCDD
1. TCDD[1] Detected
2. Precursor Level
3. Combustion Conditions
Low
High
Rank B
PCP Sludge Incineration
Carbon Regeneration
Charcoal Manufacture
Wire Reclamation
Size[2] of Source Category
Small
Large
Rank A
Sewage Sludge Incineration
Black Liquor Boilers

[1] Some researchers have reported only the total for the tetra homologue. The presence of TCDD is assumed for this ranking procedure to be adequate to indicate the potential to emit 2,3,7,8-TCDD.

[2] "Size" of category takes into consideration the number of sources, their emission volume and general location with respect to exposed populations.

[3] Some of the preliminary rankings shown on this figure have been modified in the Tier 4 Project Plan. See Table 4-8.

Figure 4-1. Ranking criteria and decision tree.

TABLE 4-5. RANKING CATEGORIES

Rank	Description
A	Large source categories (greater than 1 million tons of fuel and/or waste burned annually) with elevated dioxin precursor contamination of feed/fuel. These categories have a high potential to emit TCDD and population exposure is expected to be high.
B	Small source categories (less than 1 million tons of fuel and/or waste burned annually) or source categories with limited dioxin precursor contamination of feed/fuel. These categories have a high potential to emit TCDD, but population exposures are expected to be low.
C	Source categories less likely to emit 2,3,7,8-TCDD.
D	Source categories which have already been tested three or more times.

TABLE 4-6. CRITERIA FOR RANKING COMBUSTION SOURCE CATEGORIES

- Number of previous dioxin stack tests

- Estimated potential to emit TCDD

    - Measured TCDD levels
    - Presence of dioxin precursors in feed
        - chlorinated phenols
        - chlorinated benzenes
        - PCB's
    - Chlorine content of feed
    - Combustion conditions
        - temperature
        - local air availability
        - supplemental fuel
        - residence time
        - fuel processing

- Size of source category

    - Number of facilities
    - Quantity of fuel burned
    - Location of sources in category
    - Potential for human exposure

TABLE 4-7. SOURCE CHARACTERISTICS

Source	Size (Tons/Year)	Number of U.S. Facilities	Fuel Composition	Combustion Temperature	Air/Fuel Ratio	Air/Fuel Mixing	Number of Previous Tests	TCDD Detected
Boilers Cofiring Hazardous Wastes	$20x10^6$	-						
Industrial	---	-	PCBs, Cl-phenols	1000°C	Excess	Good	6(1)	ND-40.5 ng/m^3
Commercial	---	-	PCBs, Cl-phenols	<1000°C	Excess	Good	6(6)	
MW Incinerators								
Conventional	$10x10^6$	40	Cl-organics	500-1000°C	Excess	Poor	3	3.15-240 ng/m^3
Modular	$0.23x10^6$	90	Cl-organics	500-1000°C	Excess	Poor	1	1.2 ng/m^3
RDF Boiler	$4.5x10^6$	11	Cl-organics	1000°C	Excess	Good	3	ND-29.7 ng/m^3
Black Liquor Boilers	$42x10^6$	274	PCBs, PCPs	1000°C	Excess	Good	0	
Sewage Incinerators	$1.5x10^6$	200	Cl-organics	1000°C	Excess	Poor	2 (PCDD Scan)	483-1140 ng/m^3
PCP Sludge Incinerators			PCPs	1000°C	Excess	Good	1	0.8-3.4 ppb
Carbon Regeneration		73	PCBs	750-1000°C	Limited	Good	1	ND-$5x10^{-4}$ ppb
Wire Reclamation			PCBs, PVC	550°C	Limited	Poor	1	ND-.41 ppb
Charcoal Manufacturing	$3.7x10^6$	106	PCP	500°C	Limited	Poor	0	
Wood Boilers	$60x10^6$		PCPs	1000°C	Excess	Poor	4	.329 ppb
Woodstoves	$48x10^6$			<500°C	Low	Poor	0	
Spreader Stoker Coal				1000°C	Excess	Poor	0	
Mobile Sources				1800-2500°C	Excess	Good	9(4)	ND-.02 ppb
HW Incineration	$1x10^6$	219	PCBs, Cl-phenols	1200°C	Excess	Good	10(7)	ND-2.5 ng/m^3
Lime/Cement Kilns Cofiring Hazardous Wastes		2-3	PCBs, Cl-phenols	1400°C	Excess	Good	1	ND

Based on these ranking criteria, source categories in the preliminary source list will be ranked into one of the groups listed in Table 4-5. The Rank A group is expected to emit dioxins with the greatest potential human exposure. Rank B and C sources are expected to be less of a problem. Rank D sources are considered to be adequately tested for the purposes of the Tier 4 testing program. The implications of these rankings will be discussed in greater detail in the next section.

Source categories with three or more valid dioxin tests, using modified Method 5 train sampling and GC/MS analysis for 2,3,7,8-TCDD, are considered adequately tested for the purposes of Tier 4. TCDD analysis in valid tests should have detection limits in the ng/m^3 range or ppt for ash samples. Results of three or more valid tests are considered sufficient to indicate the potential range of 2,3,7,8-TCDD emissions from a source category. Source categories meeting these criteria are assigned a rank of D. These include municipal waste combustors[8,9,10,11,56,57] and industrial boilers cofiring wastes.[20,23,57] Seven MWC's have been tested in the United States. Several fly ash and stack tests have also been conducted in Canada and Europe. After reanalyzing archived samples from the IERL industrial boiler tests, a total of six waste fired industrial boiler tests will be completed.

The remaining source categories are ranked according to potential to emit TCDD's. Rank C source categories are categories that have been judged less likely to emit TCDD's when compared to other source categories under consideration. This is based on the following factors: (a) the level of TCDD's detected in previous tests, (b) the anticipated level of precursors in the fuel/feed, and (c) the likelihood of conditions conducive to incomplete combustion. Preliminary Rank C source categories include mobile sources, woodstoves, wood boilers, small spreader stoker coal boilers, chlorinated hazardous waste incinerators, lime/cement/aggregate kilns, commercial boilers burning chlorinated wastes, and other miscellaneous sources recommended by State and regional offices. These miscellaneous sources include open burning, apartment house flue-fed incinerators, and residential contaminated oil combustion. Additions to and/or deletions from the source categories in the preliminary Rank C category may be made in the Tier 4 Project Plan as new information is received.

Mobile sources have been tested in two earlier studies.[25,39] In both cases, TCDD's were detected at the ppt level. Chlorine content of the gasoline and diesel fuels are also low (0-100 ppm). The only case where significant quantities of chlorine may be found in gasoline is the use of ethylene dichloride (EDC) as an antiknock agent in leaded gasoline. However, with the increasing concern over atmospheric lead pollution, the use of leaded gasoline and EDC is on the decline. Based on earlier tests and chlorine content, mobile sources have been ranked C.

Dow Chemical conducted two series of tests on woodstoves.[25,38] TCDD's detected in chimney scrapings ranged from ND-370 ppt. The chlorine content of wood is less than 100 ppm. Although the combustion conditions found in wood stoves favor the formation of PCDD's, the low chlorine concentrations and the low levels of PCDD's detected in earlier studies indicate that this category is less likely to emit PCDD's. However, 48 million tons of wood are burned each year in residential woodstoves. This source category is characterized by low stacks and high particulate emissions. Thus, the potential exposure could be considerable. Woodstoves will be considered during the ash screening program. Wood fired boilers burning untreated wood, which are more efficient combustion systems with higher stacks, will also be ranked C. Boilers fired with PCP-treated wood or salt-laden wood have higher potential for dioxin emissions than boilers firing untreated wood.

Small spreader-stoker coal boilers have been placed in the Rank C category. This source category was originally considered because of combustion conditions that favor PCDD formation. These include lower combustion temperatures than the larger boilers previously tested and poor air/fuel mixing due to large feed size.[8] However, previous tests on utility boilers have not detected PCDD in stack emissions and experimental studies demonstrate that PCDD's are emitted from coal combustions at 600°C only when chlorine is added.[8,31]

Both hazardous waste incinerators and lime/cement kilns cofiring wastes have been ranked C. Elevated levels of PCDD precursors can be expected in the feed of these source categories. However, previous tests have shown only low levels of PCDD's emitted.[13,16,26] This is due to combustion conditions that are unfavorable to dioxin formation. Generally, combustion temperatures for these sources are greater than 1000°C, and the residence time for fuel ranges from 1 to 2 seconds. The use of high Btu supplemental fuel and afterburners also decreases the likelihood of PCDD emissions from these sources.

Another Rank C source category is commercial boilers cofiring waste oil containing chlorinated solvents. Many of these wastes are chlorinated aromatics. Commercial size boilers may account for about 6 million tons of RCRA waste disposal. These boilers are less efficient that the larger industrial boilers and are more likely to produce products of incomplete combustion such as dioxins. The low stack heights and urban settings of these boilers also increase the human exposure risk. However, combustion of high-chlorine content hazardous waste oils will be regulated by the Office of Solid Waste (OSW). For this reason, commercial boilers were placed in the Rank C category.

Agricultural burning, forest fires, flue-fed apartment house incinerators, and residential contaminated oil combustion have been placed in the Rank C category. These and other sources have been recommended by State and regional offices for Tier 4 testing. Burning of harvest residues and forest fires where phenoxy herbicides have been applied may be dioxin sources. Since dioxins are emitted from municipal waste combustion, smaller, less efficient apartment house incinerators may also emit dioxins. There are many of these units in urban areas, especially in the northern U. S., with approximately 2,000 in the New York City area alone. The flue-fed incinerators have the greatest potential of poor combustion conditins. Residential contaminated oil combustion may also be a dioxin combustion source. Contamination of fuel oil with chlorinated hazardous wastes has been documented in the New York City area and combustion conditions vary in residential units as they cycle on and off by thermostatic control.

Sources with high potential to emit dioxin are ranked A or B. Rank B source categories are smaller source categories (less than 1 million tons/year) or categories with lower concentrations of precursors in the feed. Preliminary Rank B source categories include PCP sludge incineration, carbon regeneration, charcoal manufacturing, and wire reclamation. Additions to and/or deletions from the source categories in the preliminary Rank B category may be made in the Tier 4 Project Plan as new information is received.

Two studies have looked at PCP waste incineration.[22,23] In both cases, PCDD's were detected in fly ash samples. Through experimental studies, PCP's have been shown to form octachlorodibenzo-p-dioxins (OCDD) during combustion.[37] Dechlorination of OCDD can result in TCDD's.[20] Annually, 19,000 tons of PCP is used to preserve wood.[58] Only a small percentage of this is incorporated in sludge which must be disposed. Typically, the sludge is incinerated at the wood preserving plant along with scrap wood. The lack of feed processing and the high moisture content of the sludge can result in poor combustion conditions. Therefore, while PCP sludge incineration is a potential source of PCDD's, the size of this category does not warrant the highest ranking for the Tier 4 program.

Activated carbon regeneration has also been placed in the Rank B category. Ppt levels of TCDD's were detected in the fly ash from the thermal regeneration of activated carbon used to treat the Cincinnati water supply. Precursor levels in the carbon were low in comparison to what might be expected in carbon used to treat an industrial waste stream. In order to prevent the combustion of the carbon, the air/fuel ratio and the combustion temperature (~800°C) are kept low.[55] These conditions promote the formation of products of incomplete combustion, such as PCDD's. There are approximately 73 carbon regeneration facilities in the United States. The actual amount of carbon thermally regenerated annually is currently not available.

Charcoal manufacturing has been designated as a Rank B source category in the preliminary ranking because of combustion conditions that favor dioxin formation. Furnace temperatures are kept low (500°C), and both air/fuel ratio and air/fuel mixing are poor.[59] Source category surveys indicate that some charcoal manufacturers use scrap wood from saw mills.

Much of this wood has been treated with PCP products for sap stain control. The combustion conditions, along with the potential use of PCP treated wood, indicate that this source category has potential to emit dioxins. Approximately 3-4 million tons of wood is used annually in the production of charcoal. However, not all of this wood is PCP treated. Tiernan has demonstrated that the combustion of clean wood (pine) does not form PCDD's.[48] The majority of charcoal manufacturing facilities are located in rural settings.

The final Rank B source category in the preliminary ranking is wire reclamation incinerators where coatings are burned off of wire and other electrical equipment to reclaim metals, primarily copper. In previous tests, ppt levels of TCDD's were detected in stack scrapings. As with carbon regeneration and charcoal manufacturing, both the combustion temperature and available oxygen are kept low in this process.[60] Wire insulation incinerated during this process often contains PCB's and polyvinyl chloride. The size of this source category is not known. However, there are 11 of these facilities in the Chicago area.[61] New York State has also cited this source as a potential problem. Secondary metals smelting plants that use PVC-containing raw materials such as whole or crushed battery separators (secondary lead) or PVC-coated wire (secondary copper) represent a related category with potential for dioxin emissions.

The remaining source categories are Ranked A. These are sewage sludge incinerators and black liquor boilers. Of the sources that have not been adequately tested, these sources are considered to have the highest potential to cause significant exposure due to dioxin emissions.

Approximately 1.5 million tons of sewage sludge is incinerated annually.[62] The high moisture content of the feed can result in poor combustion conditions. Many of these incinerators have odor and particulate problems. In addition, sewage from an industrial district may contain elevated levels of PCB's and other chlorinated aromatics. In an earlier Canadian study, PCDD's were detected in stack emissions. Many newer units are operated on a fuel efficient system. In order to save energy, both the combustion temperature and the available oxygen are held low.

Black liquor boilers are also Rank A sources. Approximately 13 percent of all fuel used in large industrial boilers is pulping liquor.[63] Some 42 million tons of this pulping liquor is disposed of in boilers.[64] Black liquor can contain significant quantities of chlorine. The use of raw wood stored in salt water will increase the chlorine content of the black liquor. In addition, earlier studies have detected elevated levels of polycyclic organic matter (POM) in the emissions of these boilers.[65] Black liquor boilers represent a very significant combustion source, which has not been characterized in terms of POM of PCDD emissions. For these reasons, the black liquor boiler source has been placed in the Rank A category.

Table 4-8 presents the preliminary ranked source list. As discussed earlier, this ranking procedure is highly subjective. In order to expand the coverage of source categories, an ash screening program will be conducted for source categories not sampled under the Tier 4 stack testing program. Sources strongly recommended by regional offices based on experience will also be included in the ash program. The following section presents the development of the testing program which is based on the ranked source list.

Some of the preliminary rankings will be modified in the Tier 4 Project Plan as new information is generated. The Project Plan ranking modifications known at the time of this writing are indicated by the footnotes in Table 4-8.

TABLE 4-8. PRELIMINARY RANKED SOURCE CATEGORY LIST

- Rank A Source Categories
  - Sewage Sludge Incinerators
  - Black Liquor Boilers

- Rank B Source Categories
  - PCP Sludge Incinerators
  - Carbon Regeneration (Industrial)
  - Charcoal Manufacturing[a]
  - Wire Reclamation Incinerators

- Rank C Source Categories
  - Commercial Boilers Firing Fuels Contaminated with Chlorinated Organic Wastes
  - Wood Stoves
  - Wood Boilers (Firing PCP-Treated Wood)[b]
  - Mobile Sources
  - Small Spreader-Stoker Coal Boilers
  - Hazardous Waste Incinerators
  - Lime/Cement Kilns Cofired with Chlorinated Organic Wastes
  - Industrial Incinerators[c]
  - Open Burning (Agricutural)
  - Apartment House Incinerators
  - Other Sources Recommended by State and Regional Offices (e.g., landfill flares, forest fires)[d]

- Rank D Source Categories
  - Municipal Solid Waste (MSW) Incineration
  - Industrial Boilers Cofiring Wastes

Rank A - Large source categories (greater than 1 million tons of fuel and/or waste burned annually) with elevated dioxin precursor contamination of feed/fuel. These categories are judged to have the highest potential to emit TCDD.

Rank B - Small source categories (less than 1 million tons of fuel and/or waste burned annually) or source categories with limited dioxin precursor contamination of feed/fuel. These categories have a high potential to emit TCDD.

Rank C - Source categories less likely to emit TCDD.

Rank D - Source categories that have already been tested three or more times.

[a] Charcoal manufacturing has been dropped to a Rank C category in the Tier 4 Project Plan. Most wood used in charcoal manufacturing is untreated.

[b] Wood boilers firing PCP-treated wood or salt-laden wood have been raised to a Rank B category in the Tier 4 Project Plan because of their higher potential for dioxin emissions. Conventional wood fired boilers remain as a Rank C category.

[c] Industrial incinerators have been raised to a Rank B category in the Tier 4 Project Plan due to the wide variety of materials incinerated.

[d] Residential contaminated oil combustion has been added to the Rank C category in the Tier 4 Project Plan.

5.0 SAMPLING PLAN DEVELOPMENT

The objective of this chapter is to develop a sampling plan that will provide data to better define the nature of the PCDD emissions problem. Prior to the development of a sampling plan, some decision regarding the scope of study had to be reached.

Data obtained from the literature review has shown that PCDD emissions from combustion sources have been studied for some time on a piecemeal basis. Various hypotheses have been advanced concerning dioxin emissions including the theory that PCDD's are a widespread contaminant from combustion processes. Environment Canada has taken the position that MWC's and forest fires are the major Canadian combustion sources emitting PCDD's.

With this diversity of opinions, there are several alternative options that could be pursued to fulfill the Tier 4 objectives. Each option has a different focus and attempts to address different aspects of the dioxin emissions issue. Four such options are considered during the sampling plan development.

Option 1: Take the Canadian position to be definitive and focus the Tier 4 efforts on MWC's and forest fires. A U. S. EPA study would rank forest fires lower due to increased U. S. industrialization and less forest acreage. Address the two prime questions: (1) Do 2,3,7,8-TCDD emissions at the concentration measured from MWC's pose an unreasonable risk to the public? (2) If so, what can be done to minimize the risk?

The work would involve several items including reviewing the previous risk assessment methodology, testing additional MWC's, and sampling forest fires. Forest fires could be sampled by perhaps sampling the plume from an aircraft or by taking ash samples. In addition, if the risk was significant, a detailed evaluation of an incinerator would have to be conducted. This would include determining the effects of various furnace operating parameters and fine-tuning the control devices.

Option 2: Test the trace chemistry of fire hypothesis for all combustion source categories. This option would involve testing as many combustion source categories as possible. The main question to be addressed would be: Which combustion sources emit 2,3,7,8-TCDD to the atmosphere?

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A reliable and relatively cheap technique would have to be developed to allow a representative number of the hundreds of different combustion source categories and subcategories to be tested. Analysis of ash samples may be a viable technique but only qualitatively.

Option 3: Develop a theoretical or empirical model of the combustion processes that lead to dioxin formation.

The modeling results will be used to address the question: Which combustion sources have the potential to emit 2,3,7,8-TCDD? It is unlikely that the model could address the follow-up question: At what concentrations?

Any modeling effort would have to be validated by some source tests which covered the range of expected types and conditions of combustion sources.

Option 4: Select a reasonable number of source categories to source test based upon the available data provided by the literature review. Attempt to select the combustion source categories with the highest potential to emit TCDD's and concentrate the available resources on these.

This option would attempt to address the questions: (1) Which combustion source categories emit significant quantities of 2,3,7,8-TCDD as measured by risk? (2) What range of concentration of 2,3,7,8-TCDD are emitted from the source categories? (3) What source characteristics (fuel type, combustion temperature, chlorine level, etc.) have the greatest effect on 2,3,7,8-TCDD emissions?

Recommended Option: Option four (4) is recommended for selection by OAQPS for the Tier 4 study because it has the potential to provide the most information to the Dioxin Management Task Force (DMTF). In addition, the Tier 4 Working Group has decided to collect and analyze ash samples for PCDD's. This information will be used to help select sources for stack testing and will help characterize sources that will not be stack tested. Maximum use will be made of the available emissions information and, in addition, a broad range of combustion source categories will be covered. With judicial source category selection based on the literature review, sufficient information should be available from the test program supplemented with ash screening to determine which source characteristics have the most effect on PCDD emissions. Even though insufficient information would be available to develop empirical models, the available results could be extrapolated to other untested combustion source categories to estimate the relative magnitude of PCDD emissions from these categories.

Option 1 is not recommended because it was felt that this option was too narrow in scope. The literature review indicated that only 15 or so source categories had been tested out of the potentially hundreds of combustion source categories and subcategories. One of the objectives of the Tier 4 study was to better define the nature of the problem. In addition, a detailed study of several incinerators has been or is being conducted to ascertain how PCDD emissions from these sources can be minimized. Instead of duplicating this ongoing effort, the Tier 4 resources could be better allocated.

Option 2 is not recommended because it was too broad in scope (i.e., lack of simple, cheap, reliable, and informative test methods). Option 3 was not selected because insufficient emissions information and source information are currently available to develop a model. The available data in the literature are very scanty and, in addition, the data were taken with various methods and at various levels of accuracy. Development of an empirical model that covered the range of combustion sources would require extensive sampling and data gathering at multiple sources and would require more resources that are currently available. Theoretical models would also require validation with test data and, consequently, development would exceed available resources.

5.1 SELECTION OF NUMBER AND TYPE OF SAMPLES TO BE COLLECTED

5.1.1 Stack Testing

The Tier 4 stack testing program will use the EPA/ASME protocol to be proposed as an ASTM method in late 1984. This protocol is based on a modified Method 5 train and includes continuous monitoring of various stack parameters. A summary of the EPA/ASME protocol is shown in Table 5-1. This has been used to develop a preliminary cost estimate for sampling at a particulate site. Depending on the number of sampling trains used and the

TABLE 5-1. SUMMARY OF DRAFT ASME PROTOCOL[*] FOR SAMPLE COLLECTION AND COST ESTIMATES

- Sampling procedures will be based on the draft ASME protocol requirements.
    - Three separate test runs
    - Sample quantities will allow for initial analysis and archived samples
    - Each source will be tested and includes the following samples:
        - Total gaseous and particulate stack emissions
        - Inlet/outlet of control devices
        - Grab samples of feed/fuel
        - Bottom ash grab samples
        - Ash or slurry from control devices
        - Precombustion air
        - Quench water effluent
        - Soil
- Standard EPA Method 5 train, modified to incorporate a sorbent module containing XAD-2.
- Emissions characterization:
    - Stack temperature
    - Moisture content
    - CO_2, CO } Continuous monitoring
    - O_2, NO_x, THC, SO_x, Opacity } Continuous monitoring
    - Total particulates
- Estimates costs $70-$130K

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[*] Data requirements set forth in the ASME protocol will be collected as a minimum. In many cases, other data will be collected. For example, total volatile compounds, HCl, total chlorine and other analyses may be generated at some sites. Operating parameters and conditions will be closely monitored and documented.

complexity of the test site, the cost per source tested will range between $70,000 and $130,000. The following documents the costs and assumptions required for five sampling scenarios.

Assumptions

1. Three samples will be collected during a 1-week test period (on-site).
2. Three weeks are required for each test site. The full crew will not be on-site the entire 3 weeks.
3. The site is "test ready", with sample ports, power, and scaffolding present.
4. There will be two categories of sites (Table 5-2):
   Simple - no control devices,
   Complex - control devices present.
5. Three tests will be run per site. These will be approximately 8-hour tests. If the site is complex, that will include six actual modified method 5 trains (3 inlet, 3 outlet).
6. The testing must be limited to 8 hours. Since there is no guarantee that PCDD's will be present, bounds must be established in the testing.
7. There will be one or two audits over the complete testing period. The cost is amortized over the complete program.
8. Van preparation is amortized over the complete program.
9. There are two types of reports costed: (1) a listing of test data with discussion, or (2) a complete report including the analytical results.
10. The resin trays, filters, and filter holder used in the Method 5 train will have to be sent to the appropriate analytical laboratory. Their return during the program for reuse is unlikely. The cost of replacement trays are included as part of the testing costs.
11. Cost scenarios include:
    a. labor,
    b. travel,
    c. per diem,
    d. supplies,
    e. shipping, and
    f. miscellaneous (extra glassware, etc.).

TABLE 5-2. COMPLEX/SIMPLE SITE COMPARISON

	Complex	Simple
Modified Method 5 trains	3 inlet 3 outlet	3 outlet
Personnel on-site	7	5

Based on these assumptions, five cost scenarios have been developed. Table 5-3 presents the costs and descriptions of the scenarios. Given the testing budget, 12 sources can be tested. Obviously, this number of tests would be inadequate to characterize all of the combustion source categories on the ranked listed. In addition, there is marked uncertainty with the absolute ranking results discussed earlier since the ranking procedures are largely subjective.

5.1.2 Ash Screening

A tool to screen source categories during the Tier 4 program would be very beneficial to prevent wasting limited resources. Because of the tight schedule, limited budget, and large number of combustion source categories and subcategories, any screening technique would need to be quick to perform, inexpensive, applicable to many sources, and a responsible indicator of TCDD emissions from a source category.

Unfortunately, there are no proven screening techniques that can be used to estimate TCDD emissions from combustion sources. Two screening methods have been considered. These are (1) a PCDD precursor scan and PCDD scan of the fuel, and (2) a PCDD scan of ash samples. The fuel analysis method has several problems. Although fuel analysis is considered during ranking of source categories and is discussed at length in the literature review, this method does not consider the combustion conditions of the source. In addition, fuels are often heterogeneous and difficult to handle. On the other hand, ash analysis may have some merit as a screening tool providing a qualitative indication of those source categories which may emit TCDD's. The following paragraphs discuss the validity of using ash screening instead of the stack testing.

Use of ash samples for screening of combustion sources has several advantages. These include:

(1) There is usually a significant quantity of easily accessible ash in the hoppers of the control devices on combustion sources.

(2) The ash is usually homogeneous and can be readily extracted without a lot of preparation work.

TABLE 5-3. COST SCENARIOS

Scenario	Cost	Remarks
1	70,000	Simple site, report is listing of data
2	77,000	Complex site, report is listing of data
3	85,000	Simple site, complete report including sampling and analytical results.
4	90,000	Complex site, complete report including sampling and analytical results.
5	130,000	Complex site, double trains, complete report including sampling and analytical results.

(3) Taking of ash samples does not require a lot of sampling equipment.

(4) Ash supplies can be shipped easily.

(5) An ash sample can be screened for PCDD's (tetra- through octa-homologues) for $500-1,000.

There are several disadvantages to using ash samples. These include:

(1) The dioxin in the ash is not a true indicator of the dioxin emitted in the flue gas. One study has shown that PCDD's can be enriched on smaller particles.[12] A large portion of the small particles is not captured by the control device and is emitted from the source. Another study showed that there was selective partitioning of homologues between the flue gas and the particulate matter (fly ash and bottom ash).[20] Specifically, TCDD's concentrated in the flue gas while the higher chlorinated homologues concentrated in the ash particulates.

(2) Absence of TCDD's in the ash samples does not guarantee the absence of TCDD's in the flue gas. Table 5-4 shows flue gas and fly ash analyses for several municipal waste incinerators where both types of samples were taken. The data do indicate that PCDD ash analysis could be used as an relative indicator of the presence of TCDD emissions. However, the data trends show that the PCDD data could not be used for estimating TCDD emission rates from the sources screened.

Despite the above mentioned disadvantages, ash sampling and analysis will be useful in the ranking process for combustion sources. However, to get maximum utility from the ash sampling and analysis, some additional source data should be obtained at the same time as the ash sample is collected. For example, source characteristics that should be collected include fuel type and degree of processing, combustion conditions, and control device specifications (including inlet and outlet temperatures) so that a thermal history of the ash can be ascertained.

5.2 NUMBER OF SOURCES TO BE TESTED IN A PARTICULAR CATEGORY

The number of sources to be tested within a source category should depend upon several factors including the intent of the testing, the number

TABLE 5-4. COMPARISONS OF FLUE GAS AND ESP ASH DIOXIN CONTENTS

Reference	Stack (ng/m^3) TCDD	Stack (ng/m^3) PCDD	ESP Ash(ppb) TCDD	ESP Ash(ppb) PCDD
11 (U.S.A.)	240	2,300	170	800
4 (Italy #2)	189.2	48,997	0.25	599.8
4 (Italy #4)	70.9	4,409	46.4	3,535
7 (9 facilities)	57	1,540	93	2,056
9 (U.S.A.)	20.14	-	7.3	-
4 (Italy #3)	19	7,509	ND	7.32
4 (Italy #6)	19	587.8	ND	5.9
4 (Italy #5)	9.9	1,030	0.7	0.9
8 (Chicago)	6.3	45.4	ND	ND
10 (Ames)	ND	ND	ND	ND

* Furnace Ash

ND= None detected

of sources previously tested, and the budget. Preliminary calculations were made to estimate how many sources within a source category would be needed to statistically characterize the average emissions from the source category within a given confidence interval.

The municipal waste incineration with heat recovery source subcategory was chosen as an example since there are a number of source tests for this category providing some initial knowledge on the emissions variability. Appendix B illustrates the calculations made. The calculations show that to statistically characterize this subcategory with a 95 percent confidence interval, 14-39 tests would be required. Thirty-nine tests are required if all six previous tests are used in the calculations. Fourteen tests are required if the high and low values are dropped from the calculations. The facility with the high value (240 ng/m^3) has undergone modifications and will be retested. The MWC with the low value (ND) was fired with refuse-derived fuel and coal. Assuming $60,000 per source test, the entire Tier 4 budget would be used on one source category.

A reasonable number of source tests and screens should be performed with each source category to enable an estimate of the mean emissions to be made. The confidence intervals around these mean emissions should be fairly narrow to allow comparison between source categories. The confidence interval around a mean is given by:

$$\bar{x} \pm \left(\frac{t_{\alpha} S}{\sqrt{N}}\right)$$

The size of the confidence interval, therefore, varies with the size of the sample (n) and the value of the t statistic. The size of the t value varies with the degrees of freedom (number of samples -1) and the confidence level chosen. Some example values of the t statistic are shown below.

Number of Samples	t Statistic $t_{.05}$	$t_{.10}$
2	12.706	6.314
3	4.303	2.920
4	3.182	2.353
5	1.96	2.132

Inspection of this table shows that beyond three samples, there are diminishing returns. Similarly, the effects of $1/\sqrt{n}$ diminish beyond n=3. For these reasons, a sample size of three was suggested as optimal for the purpose of this study. Based on the Tier 4 budget and the number of source categories considered, three source tests per source category is considered practical.

5.3 SELECTION OF THE SOURCE TEST PLAN

This section describes the initial rational underlying the selection of a source test plan. This test plan was used in the draft Tier 4 project plan. Following receipt of comments concerning the project plan, the source test plan was revised, and the schedule for ash screening was amended. The reader is advised to consult the latest version of the Tier 4 project plan for current test plans. Several options were initially considered for the source test plan. These are shown in Table 5-5. These include (1) complete coverage (3 tests) of all listed sources, (2) broad coverage of all listed source categories, and (3) a recommended plan. Option 1 is not acceptable due to budget restraints. Option 2 does not provide any statistical significance for the results. Following review by the Tier 4 Working Group and after considering comments by the various regions, Option 3 was recommended along with ash screening.

The recommended test plan including ash screening is shown in Table 5-6. This test plan assumes that the testing would be phased. Complete stack tests would be initiated in 1984 for sewage sludge incinerators and black liquor boilers. A portion of the testing budget would be set aside for screening of the remaining B and C ranked sources and other source categories recommended by the regions.

TABLE 5-5. PRELIMINARY SOURCE TEST PLAN OPTIONS FOR STACK EMISSIONS

Source	Number of Recommended Tests Option 1	Option 2	Option 3
Rank A Sources			
Sewage Sludge Incinerator	2	1	2
Black Liquor Boilers	3	1	3
Rank B Sources[a]			
PCP Sludge Incinerator	2	1	
Carbon Regeneration (Industrial)	2	1	
Charcoal Manufacturing[b]	3	1	
Wire Reclamation	2	1	
Rank C Sources			
Commercial Boilers	3	1	2
Mobile Sources[c]	2	1	2
Wood Stoves	3	1	
Wood Boilers (PCP Treated)	3	0	
Small Spreader Stoker Coal Boiler	3	0	
Hazardous Waste Incineration	1	0	
Lime/Cement Kilns (HW)	2	0	
Rank D Sources			
MSW Incineration[d]	1	1	1
Industrial Boilers Cofiring Wastes	0	0	0
TOTAL	32	10	10

Option 1: Three test coverage of potential source categories.
Option 2: Single source coverage of potential source categories.
Option 3: Recommended stack test plan, focused on source categories with greatest potential.

[a] Industrial incinerators and wood fired boilers firing PCP-treated wood and/or salt-laden wood have been added to the Rank B category in the Tier 4 Project Plan.

[b] Charcoal manufacturing has been dropped to a Rank C category in the Tier 4 Project Plan. Most wood used in charcoal manufacturing is untreated.

[c] $10K - allocated to EPA Environmental Science Research Laboratory in Research Triangle Park for emissions testing.

[d] The preliminary source test plan recommended a retest of the Hempstead MSW incineration facility. This facility will be closed for the duration of the Tier 4 test program. The Tier 4 Project Plan does not call for a test of an MSW incineration unit.

TABLE 5-6. PRELIMINARY RECOMMENDED SOURCE TEST PLAN FOR STACK EMISSIONS INCLUDING ASH SCREENING

Source	Number of Recommended Tests		Number Screened
	1984	1985	
Rank A Sources			
Sewage Sludge Incinerator	2		
Black Liquor Boilers	3		
Rank B Sources		5 Total	
PCP Sludge Incinerator			3
Carbon Regeneration (Industrial)			3
Charcoal Manufacturing[a]			3
Wire Reclamation			3
Rank C Sources		2 Total	
Commercial Boilers Firing Waste Oils	b		
Mobile Sources			
Wood Stoves			3
Wood Boilers (PCP Treated)[c]			3
Small Spreader Stoker Coal Boiler	1[d]		
Hazardous Waste Incineration			3
Agricultural Burning			
Lime/Cement Kilns (HW)			3
Apartment House Incinerators			
Rank D Sources			
MSW Incineration[e]		1	3
Industrial Boilers Cofiring Wastes			3
Other Categories[f]		2-3	30

[a] Charcoal manufacturing has been dropped to a Rank C category in the Tier 4 Project Plan. Industrial incinerators have been added to the Rank B category in the Tier 4 Project Plan.

[b] 10K - allocated to EPA Environmental Research Laboratory for emissions testing.

[c] Wood boilers firing PCP-treated wood or salt-laden wood have been raised to a Rank B category in the Tier 4 Project Plan.

[d] Expand sampling and analysis of IERL Cincinnati spreader stoker test.

[e] The preliminary source test plan recommended a retest of the Hempstead Facility. This facility will be closed for the duration of the Tier 4 test program. The Tier 4 Project Plan does not call for a test of an MSW incineration unit.

[f] Categories recommended by the States and regions as having the highest potential of ash contamination.

Three facilities would be ash sampled from each source category under consideration.

Early in the testing program, State and regional offices will be asked to collect ash samples and source information from candidate facilities with the potential for dioxin emissions. Ideally, results of the ash screening test would be used to determine which of the Rank B or C sources warrant stack testing. However, the Tier 4 schedule may require that the ash sampling and emissions testing be performed concurrently. In that case, the ash screening data will serve to qualitatively expand the dioxin emissions data base.

A small spreader stoker boiler is being tested in the near future by IERL. This test effort could be readily expanded to include PCDD sampling and analysis. This source category is included in the recommended plan. In addition, approximately $10,000 has been allocated to EPA Environmental Science Research Laboratory in Research Triangle Park, NC to obtain samples for PCDD analysis of mobile sources.

5.4 SELECTION OF TYPES OF SAMPLES AND ANALYSIS

The intent of the source testing is not only to provide an estimate of the amount of 2,3,7,8-TCDD emissions from a given source, but is also to gather additional data about the source to determine if PCDD emitted from the source has contaminated its surroundings. In addition to stack samples, water and soil samples will be collected. Ash samples will also be collected and used to determine the levels of TCDD's in the solid wastes. Comparison of the ash analyses to the flue gas analyses will allow the validity of the ash screening tool to be checked. Table 5-7 summarizes the types of samples and analyses recommended for each source test.

The analyses of these samples will include the tetra and above dioxin homologues as well as 2,3,7,8-TCDD. Analysis for furans homologues is also included. The fuel/feed samples will also be analyzed for PCB's, total organic chlorine, chlorinated phenols, and chlorinated benzenes, since these compounds may be precursors of PCDD's.

TABLE 5-7. RECOMMENDED SAMPLING AND ANALYSIS

Sample	Method	Recommended (Samples/Day)	Recommended Analyses	Total Samples[a] for Analysis
Inputs				
Precombustion Air	XAD-2 (PUFF)[b]	0-1[c]	2,3,7,8-TCDD, PCDD[d], TOCL[e], Cl-phenols, Cl-Benzenes	1[c]
Feed/Fuel	Grabs	Daily Composite	PCDD Scan, Cl-phenols, Cl-benzenes PCB, TOCL	3[f]
Outputs				
Stack (before control)	MM5T	2 trains -Back half daily composite -condenser rinse -adsorbent resin -Front half daily composite -cyclone catch -filter -probe rinse	2,3,7,8-TCDD, Homologues[h] (tetra - octa), PCDD	6
Stack (after control)	MM5T	2 trains -Back half daily composite -condenser rinse -adsorbent resin -Front half daily composite -filter catch -probe rinse	2,3,7,8-TCDD, Homologues (tetra - octa), PCDD	6
Bottom Ash	Grabs	Daily Composite	2,3,7,8-TCDD, Homologues (tetra - octa), PCDD	3
Ash from Control Device	Grabs	Daily Composite	2,3,7,8-TCDD, Homologues (tetra - octa), PCDD	3
Quench Water Effluent	Grabs	Daily Composite	2,3,7,8-TCDD, Homologues (tetra - octa), PCDD	3
Other				
Soils (in vicinity)	Boring	1 Composite	2,3,7,8-TCDD, Homologues (tetra - octa), PCDD	1
			TOTAL	26[i]

[a] Based on 3 sampling days.

[b] XAD-3 (PUFF) denotes a modified high volume air sampler with a special sampling head for ambient organic compounds.

[c] Sample to be collected if there is a significant source of suspected precursors in vicinity of sampling site.

[d] PCDD = Polychlorinated dibenzo dioxin.

[e] TOCL = Total organic chlorine.

[f] Analysis by contractor.

[g] MM5T is a modified EPA "Method 5" train as defined in the ASME protocol.

[h] Homologues = Analyss done on higher (tetra through octa) PCDD's as a total for each group only.

[i] Multiple analyses for each sample will have a multiplier effect on the analytical costs also. Total does not include quality assurance samples (approximately 20 percent).

Input Samples. Precombustion air will be sampled at sources where air contamination may be a factor in stack emissions. Heavily industrialized areas may have high concentrations of precursors or dioxin in the background air. For example, when testing a PCP sludge incinerator located at a wood preserving facility, precombustion air should be analyzed for chlorinated phenols. The decision to test precombustion air will be made during a pretest survey. If collected, precombustion air samples will be analyzed for PCDD's, PCB's, chlorinated phenols, chlorinated benzenes, and total organic chlorine (TOCl).

During stack testing, fuel/feed samples will be collected every 4 hours and composited daily. These samples will be analyzed for total PCDD's, chlorinated phenols, chlorinated benzenes, PCB's, and total chlorine. The sampling contractor will be responsible for analyzing the sample for nondioxin constituents.

Output Samples. Stack samples will be taken before and after control devices. The stacks will be sampled using the EPA/ASME sampling protocol with an EPA modified Method 5 train. Daily gaseous and particulate samples will be composited separately. Grab samples of control device ash, bottom ash, and quench water will be collected every 4 hours and composited daily. All output samples will be sent to a centralized laboratory (Troika) and analyzed for 2,3,7,8-TCDD, dioxin homologues (and furan homologues).

Environmental Samples. Soil borings will be collected at the source facility around ash handling and fuel storage areas. Composite samples will be sent to a centralized laboratory (Troika) and analyzed for 2,3,7,8-TCDD, dioxin homologues, and furan homologues. This data will provide some historic information on PCDD deposition at the facility.

APPENDIX A

DIOXIN DATA BASE

APPENDIX A: DIOXIN DATA BASE

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Key to Abbreviations A-2

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KEY TO ABBREVIATIONS

dscm = Dry Standard Cubic Meter
ESP = Electrostatic Precipitator
FA = Fly Ash
FG = Flue Gas
g = Gram
GC = Gas Chromatography
GS = Grab Sample
HRGC = High Resolution Gas Chromatography
HRMS = High Resolution Mass Spectrophotometry
M^3 = Cubic Meter
MM5T = Modified Method 5 Train
MS = Mass Spectrophotomer
N/A = Not Available
ND = None Detected
ng = Nanogram
NM3 = Normal Cubic Meter
ppb = Parts Per Billion
ppm = Parts Per Million
ppt = Parts per Trillion
µg = Micrograms

Data Rating:

Good (G): FG Sampling by MM5T (or similar train), and analysis by GC/MS, and complete data.

Poor (P): Inappropriate sampling or analysis methodology.

Incomplete (I): Incomplete data on methodology. Lack of detection limits when ND is recorded.

*: Preliminary data subject to change.

REF #	SOURCE TYPE	FACILITY
13	HW INCINERATION	Rollins, Dear Park, TX
13	HW INCINERATION	Ensco, El Dorado, ARK
13	HW INCINERATION	Ensco, El Dorado, ARK
13	HW INCINERATION	Rollins, Dear Park, TX
13	HW INCINERATION	Ensco, El Dorado, ARK
13	HW INCINERATION	Rollins, Dear Park, TX
13	HW INCINERATION	Ensco, El Dorado, ARK
13	HW INCINERATION	Rollins, Dear Park, TX
13	HW INCINERATION	Rollins, Dear Park, TX
13	HW INCINERATION	Rollins, Dear Park, TX
13	HW INCINERATION	Ensco, El Dorado, ARK
*15	HW INCINERATION	NJ
*15	HW INCINERATION	NJ
*16	HW INCINERATION	Mitchell, NC
*16	HW INCINERATION	DuPont, LA
*16	HW INCINERATION	Upjohn, TX
*16	HW INCINERATION	Upjohn, TX
*16	HW INCINERATION	Ross, OH
*16	HW INCINERATION	Am.Cyanamid, WV
*16	HW INCINERATION	Ross, OH
*16	HW INCINERATION	Am.Cyanamid, WV
*16	HW INCINERATION	Abco, SC
*16	HW INCINERATION	Am.Cyanamid, WV
*16	HW INCINERATION	Abco, SC
*16	HW INCINERATION	Am.Cyanamid, WV
*16	HW INCINERATION	Upjohn, TX
*16	HW INCINERATION	Mitchell, NC
*16	HW INCINERATION	DuPont, LA
*16	HW INCINERATION	Mitchell, NC
*16	HW INCINERATION	Ross, OH
*16	HW INCINERATION	Mitchell, NC
*16	HW INCINERATION	Abco, SC
*16	HW INCINERATION	DuPont, LA
*16	HW INCINERATION	Ross, OH
*16	HW. INCINERATION	Upjohn, TX
*16	HW INCINERATION	Abco, SC
*16	HW INCINERATION	DuPont, LA
17	HW INCINERATION	Los Alamos Pilot Study
17	HW INCINERATION	Los Alamos Pilot Study
17	HW INCINERATION	Los Alamos Pilot Study
18	CEMENT KILNS	San Juan Cement, Puerto Rico
19	HW INCINERATION	M/T Vulcanus
19	HW INCINERATION	M/T Vulcanus
26	HW INCINERATION	M/T Vulcanus
26	HW INCINERATION	M/T Vulcanus
26	HW INCINERATION	M/T Vulcanus
26	HW INCINERATION	M/T Vulcanus
57	HW INCINERATION	Northeast Utility Boiler
101	HW INCINERATION	JM Huber Corp.

HAZARDOUS WASTE INCINERATORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METH
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
13	Rotary Kiln with Afterburner (1200 C)	Stack	FG	MM5T
*15	Rotary Kiln (1200C)	Stack	FA/FG	MM5T
*15	Rotary Kiln (1200C)	Stack	FA/FG	MM5T
*16	Liquid Injection	Stack	FG/FA	MM5T
*16	Rotary Kiln/Liquid Injection	-----	Feed	GS
*16	Horiz. Cyl. Thermal Oxidizer	Stack	FG/FA	MM5T
*16	Horiz. Cyl. Thermal Oxidizer	Stack	FG/FA	MM5T
*16	Rotary Kiln	-----	Feed	GS
*16	2 Chambers	-----	Feed	GS
*16	Rotary Kiln	Stack	FG/FA	MM5T
*16	2 Chambers	-----	Feed	GS
*16	2 Stage Boiler	-----	Feed	GS
*16	2 Chambers	Stack	FG/FA	MM5T
*16	2 Stage Boiler	Stack	FG/FA	MM5T
*16	2 Chambers	Stack	FG/FA	MM5T
*16	Horiz. Cyl. Thermal Oxidizer	-----	Feed	GS
*16	Liquid Injection	-----	Feed	GS
*16	Rotary Kiln/Liquid Injection	Stack	FG/FA	MM5T
*16	Liquid Injection	-----	Feed	GS
*16	Rotary Kiln	Stack	FG/FA	MM5T
*16	Liquid Injection	Stack	FG/FA	MM5T
*16	2 Stage Boiler	Stack	FG/FA	MM5T
*16	Rotary Kiln/Liquid Injection	Stack	FG/FA	MM5T
*16	Rotary Kiln	-----	Feed	GS
*16	Horiz. Cyl. Thermal Oxidizer	-----	Feed	GS
*16	2 Stage Boiler	-----	Feed	GS
*16	Rotary Kiln/Liquid Injection	-----	Feed	GS
17	Controlled Air Incineration (1370C)	Furnace	Ash	GS
17	Controlled Air Incineration (1370C)	Scrubber	Liquid	GS
17	Controlled Air Incineration (1370C)	Stack	FG/FA	MM5T
18	1260 C, RT = 1.5 sec	Stack	FG	M5T
19	Incinerator Ship (7/77 - 8/77)	feed		GS
19	Incinerator Ship (7/77 - 8/77)	stack	FA/FG	BIT
26	1600C, RT=1.35, (8/82)	-----	Feed	GS
26	1600C, RT=1.35, (8/82)	Stack	FG	MM5T
26	1600C, RT=1.35, (8/82)	Stack	FG	MM5T
26	1600C, RT=1.35, (8/82)	-----	Feed	GS
57	10% Waste Oil	Stack	FG/FA	MM5T/SS
101	PCB Pyrolysis (2000 C)	Stack	FG/FA	MM5T

HAZARDOUS WASTE INCINERATORS

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
13	4 Hours	Soxhlet/Benzene	GC/HRMS
*15	3 Runs	N/A	GC/MS
*15	3 Runs	N/A	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
*16	N/A	Soxhlet/Methylene Chloride	GC/MS
17	N/A	Soxhlet/Toluene	GC/MS
17	N/A	Soxhlet/Toluene	GC/MS
17	N/A	Soxhlet/Toluene	GC/MS
18	4 Samples	Soxhlet/Benzene	GC/MS
19	13 days / 6 weeks	Basic Extraction	GC/MS
19	13 days / 6 weeks	Basic Extraction	GC/MS
26	10 Tests/13 Days	Soxhlet/Hexane	GC/HRMS
26	10 Tests/13 Days	Soxhlet/Hexane	GC/HRMS
26	10 Tests/13 Days	Soxhlet/Hexane	GC/HRMS
26	10 Tests/13 Days	Soxhlet/Hexane	GC/HRMS
57	3 Days	Soxhlet/Hexane	GC/MS
101	4 tests	N/A	GC/MS

HAZARDOUS WASTE INCINERATORS

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILIT
13	0.5 ng°	TCDD	0.741 ng/Nm3	N/A
13	0.45 ng	TCDD	ND	N/A
13	0.5 ng	TCDF	2.14 ng/Nm3	N/A
13	(0.9) ng	TCDF	10 ng/Nm3	N/A
13	.66 ng	TCDD	0.171 ng/Nm3	N/A
13	0.8 ng	TCDF	4.82 ng/Nm3	N/A
13	.2 ng	TCDF	0.56 ng/Nm3	N/A
13	.9 ng	TCDD	ND	N/A
13	0.4 ng	TCDD	2.48 ng/Nm3	N/A
13	(0.48) ng	TCDD	0.645 ng/Nm3	N/A
13	.07 ng	TCDD	.072 ng/Nm3	N/A
*15	N/A	2,3,7,8 TCDD	ND	N/A
*15	N/A	PCDD	ND - 365 ng	N/A
*16	N/A	TCDF	0.7 ng/m3	N/A
*16	N/A	TCDF	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDF	6.8 ng/m3	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDF	ND	N/A
*16	N/A	TCDD	Detected	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDD	15 ng/m3	N/A
*16	N/A	TCDF	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDF	Detected	N/A
*16	N/A	TCDF	ND	N/A
*16	N/A	TCDD	ND	N/A
*16	N/A	TCDF	40 ng/m3	N/A
*16	N/A	TCDF	ND	N/A
*16	N/A	TCDF	ND	N/A
*16	N/A	TCDF	Detected	N/A
*16	N/A	TCDF	Detected	N/A
*16	N/A	TCDD	ND	N/A
17	N/A	PCDD/PCDF	ND	N/A
17	N/A	PCDD/PCDF	ND	N/A
17	N/A	PCDD/PCDF	ND	N/A
18	14.9 ng/m3	PCDD/PCDF	ND	N/A
19	0.2 ppm	TCDD	0.98 ppm	ND - 2.4 ppm
19	N/A	TCDD	ND	N/A
26	N/A	TCDD	ND	N/A
26	N/A	TCDF	47.5 ng/g	25 - 80 ng/g
26	N/A	TCDD	ND	N/A
26	N/A	TCDF	N/A	0.3 - 3 ng/m3
57	5 ng/ul	PCDD/PCDF	ND	N/A
101	0.5 ug/m3	PCDD/PCDF	ND	N/A

HAZARDOUS WASTE INCINERATORS

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
13	PCBs Plus Fuel Oil	TRW/Wright St. U.	G
13	PCBs Plus Fuel Oil	TRW/Wright St. U.	G
13	Waste Chem Plus PCBs	TRW/Wright St. U.	G
13	Waste Chem Plus PCBs	TRW/Wright St. U.	G
13	Waste Chem Plus PCBs	TRW/Wright St. U.	G
13	Waste Chemicals	TRW/Wright St. U.	G
13	Waste Chemicals	TRW/Wright St. U.	G
13	PCBs Plus Fuel Oil	TRW/Wright St. U.	G
13	Waste Chemicals	TRW/Wright St. U.	G
13	Waste Chem Plus PCBs	TRW/Wright St. U.	G
13	Waste Chemicals	TRW/Wright St. U.	G
*15	Silvex Herbicide	Roy F. Weston	I
*15	Silvex Herbicide	Roy F. Weston	I
*16	Liq Org(.4-1%Cl)	MRI	I
*16	Liq/Sol(.05-16%Cl)	MRI	I
*16	Liq/Gaseous (21%Cl	MRI	I
*16	Liq/Gaseous (21%Cl	MRI	I
*16	Liq Org (.02-6.2%Cl)	MRI	I
*16	Analine Wast(0.15%Cl	MRI	I
*16	Liq Org (.02-6.2%Cl)	MRI	I
*16	Analine Wast(0.15%Cl	MRI	I
*16	Liq Org (.4-6.6%Cl)	MRI	I
*16	Analine Wast(0.15%Cl	MRI	I
*16	Liq Org (.4-6.6%Cl)	MRI	I
*16	Analine Wast(0.15%Cl	MRI	I
*16	Liq/Gaseous (21%Cl)	MRI	I
*16	Liq Org(.4-1%Cl)	MRI	I
*16	Liq/Sol(.05-16%Cl)	MRI	I
*16	Liq Org(.4-1%Cl)	MRI	I
*16	Liq Org (.02-6.2%Cl)	MRI	I
*16	Liq Org(.4-1%Cl)	MRI	I
*16	Liq Org (.4-6.6%Cl)	MRI	I
*16	Liq/Sol(.05-16%Cl)	MRI	I
*16	Liq Org (.02-6.2%Cl)	MRI	I
*16	Liq/Gaseous (21%Cl)	MRI	I
*16	Liq Org (.4-6.6%Cl)	MRI	I
*16	Liq/Sol(.05-16%Cl)	MRI	I
17	PCP Treated Wood	Los Alamos Nat. Lab.	I
17	PCP Treated Wood	Los Alamos Nat. Lab.	I
17	PCP Treated Wood	Los Alamos Nat. Lab.	I
18	Pharm.Wastes(21%cl)	Monsanto Research Corp.	G
19	Herbicide Orange	TRW, Inc.	G
19	Herbicide Orange	TRW, Inc.	I
26	PCB-Cont. Waste	TRW	I
26	PCB-Cont. Waste	TRW	G
26	PCB-Cont. Waste	TRW	I
26	PCB-Cont. Waste	TRW	G
57	PCB Waste Oil	GCA	G
101	PCBs	Radian Corp.	G

ACCIDENTAL FIRE

REF #	SOURCE TYPE	FACILITY
34	ACCIDENTAL FIRE	N.Y. State Transformer
34	ACCIDENTAL FIRE	N.Y. State Transformer
34	ACCIDENTAL FIRE	N.Y. State Transformer
36	ACCIDENTAL FIRE	Stockholm, Sweden
36	ACCIDENTAL FIRE	Stockholm, Sweden
36	ACCIDENTAL FIRE	Stockholm, Sweden
36	ACCIDENTAL FIRE	Stockholm, Sweden
36	ACCIDENTAL FIRE	Stockholm, Sweden
35	ACCIDENTAL FIRE	San Fransisco
35	ACCIDENTAL FIRE	San Fransisco
35	ACCIDENTAL FIRE	San Fransisco
35	ACCIDENTAL FIRE	San Fransisco
35	ACCIDENTAL FIRE	San Fransisco
35	ACCIDENTAL FIRE	Chicago
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
47	ACCIDENTAL FIRE	Skoude, Sweden
124	ACCIDENTAL FIRE	Binghamton, NY
124	ACCIDENTAL FIRE	Binghamton, NY

ACCIDENTAL FIRE

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHOD
34	N/A	Capac/Wall	Liquid	Wipe
34	N/A	Capacitor	Soot	GS
34	N/A	Capac/Wall	Liquid	Wipe
36	Transformer Station (1978)	Intact Cap	Liquid	GS
36	Transformer Station (1978)	In Exp Cap	Liquid	GS
36	Transformer Station (1978)	On Exp Cap	Liquid	Scraping
36	Transformer Station (1978)	Fence	Ash	Scraping
36	Transformer Station (1978)	Pine Need.	Ash	GS
35	PCB Transformer	N/A	Liquid	GS
35	PCB Transformer	N/A	Liquid	GS
35	PCB Transformer	N/A	Soot	wipe
35	PCB Transformer	N/A	Soot	wipe
35	PCB Transformer	N/A	Soot	wipe
35	PCB Transformer	N/A	Soot	wipe
47	Capacitor Battery Fire	In Fire	Soot	Wipe Test
47	Capacitor Battery Fire	In Fire	Soot	Wipe Test
47	Capacitor Battery Fire	In Fire	Soot	Wipe Test
47	Capacitor Battery Fire	Near Fire	Soot	Wipe Test
47	Capacitor Battery Fire	Near Fire	Soot	Wipe Test
47	Capacitor Battery Fire	Near Fire	Soot	Wipe Test
47	Capacitor Battery Fire	Wall(2m)	Soot	Wipe Test
47	Capacitor Battery Fire	Bench(10m)	Soot	Wipe Test
124	Office Building (Feb. 1981)	Transform.	Soot	Scraping
124	Office Building (Feb. 1981)	Transform.	Soot	Scraping

ACCIDENTAL FIRE

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
34	N/A	N/A	N/A
34	N/A	N/A	N/A
34	N/A	N/A	N/A
36	N/A	Hexane	GC/MS
36	N/A	Hexane	GC/MS
36	N/A	Hexane	GC/MS
36	N/A	Hexane	GC/MS
36	N/A	Hexane	GC/MS
35	N/A	N/A	N/A
35	N/A	N/A	N/A
35	N/A	N/A	N/A
35	N/A	N/A	N/A
35	N/A	N/A	N/A
35	N/A	N/A	N/A
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
47	N/A	N/A	HRGC/MS
124	2 floors, 2 repli.	Soxhlet/Benzene	GC/MS
124	2 floors, 2 repli.	Soxhlet/Benzene	GC/MS

ACCIDENTAL FIRE

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILITY
34	N/A	TCDD	N/A	30 - 500 pg
34	N/A	2,3,7,8 TCDD	1.2 ng	N/A
34	N/A	TCDF	N/A	20 - 400 ng
36	N/A	PCDF	N/A	0.9 - 1.1 ppm
36	N/A	PCDF	75 ppm	N/A
36	N/A	PCDF	N/A	27 - 52 ppm
36	N/A	PCDF	ND	N/A
36	N/A	PCDF	ND	N/A
35	N/A	TCDF	0.127 ppm	N/A
35	N/A	TCDD	ND	N/A
35	N/A	TCDF	28.9 ppm	N/A
35	N/A	TCDD	0.324 ppm	N/A
35	N/A	2,3,7,8 TCDD	0.059 ppm	N/A
35	N/A	PCDD/PCDF	ND	N/A
47	N/A	2,3,7,8 TCDD	20 ng/m2	N/A
47	N/A	TCDD	100 ng/m2	N/A
47	N/A	PCDD	213 ng/m2	N/A
47	N/A	2,3,7,8 TCDD	100 ng/m2	N/A
47	N/A	TCDD	600 ng/m2	N/A
47	N/A	PCDD	873 ng/m2	N/A
47	N/A	PCDD	ND	N/A
47	N/A	PCDD	ND	N/A
124	N/A	2,3,7,8 TCDD	2.85 ppm	N/A
124	N/A	2,3,7,8 TCDF	195 ppm	120 - 270 ppm

ACCIDENTAL FIRE

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
34	PCBs	N.Y. State Dept. of Health	I
34	PCBs	N.Y. State Dept. of Health	I
34	PCBs	N.Y. State Dept. of Health	I
36	PCBs	Nat. Swedish Env. Prot. Board	I
36	PCBs	Nat. Swedish Env. Prot. Board	I
36	PCBs	Nat. Swedish Env. Prot. Board	I
36	PCBs	Nat. Swedish Env. Prot. Board	I
36	PCBs	Nat. Swedish Env. Prot. Board	I
35	PCBs	N/A	I
35	PCBs	N/A	I
35	PCBs	N/A	I
35	PCBs	N/A	I
35	PCBs	N/A	I
35	PCBs	N/A	I
47	PCBs	Univ. of Umea, Sweden	G
47	PCBs	Univ. of Umea, Sweden	G
47	PCBs	Univ. of Umea, Sweden	G
47	PCBs	Univ. of Umea, Sweden	G
47	PCBs	Univ. of Umea, Sweden	G
47	PCBs	Univ. of Umea, Sweden	G
47	PCBs	Univ. of Umea, Sweden	I
47	PCBs	Univ. of Umea, Sweden	I
124	PCBs, Chlor. Benzene	NY State	G
124	PCBs, Chlor. Benzene	NY State	G

DOMESTIC SOURCES

REF #	SOURCE TYPE	FACILITY
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
25	DOMESTIC	N/A
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Cape Cod, MA
38	DOMESTIC	Midland, Mich.
38	DOMESTIC	Midland, Mich.
38	DOMESTIC	Midland, Mich.
38	DOMESTIC	Midland, Mich.
38	DOMESTIC	Midland, Mich.

DOMESTIC SOURCES

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHC
25	25 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	25 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	25 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	25 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	25 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	12 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	12 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	12 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	12 yr old Fireplace	CHIMNEY	ASH	SCRAPI
25	Natural Gas Furnace	ESP	FA	GS
25	Natural Gas Furnace	ESP	FA	GS
25	Natural Gas Furnace	ESP	FA	GS
25	Natural Gas Furnace	ESP	FA	GS
25	Natural Gas Furnace	ESP	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Flue Pipe	FA	GS
38	N/A	Chimney	FA	GS
38	N/A	Chimney	FA	GS
38	N/A	Chimney	FA	GS
38	N/A	Chimney	FA	GS
38	N/A	Chimney	FA	GS

DOMESTIC SOURCES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/EC
25	N/A	N/A	GC/EC
25	N/A	N/A	GC/EC
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS
38	N/A	N/A	GC/MS

DOMESTIC SOURCES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILI
25	0.04 ppb	2,3,7,8 TCDD	0.1 ppb	N/A
25	N/A	TCDD	0.37 ppb	N/A
25	N/A	H6CDD	3.4 ppb	N/A
25	N/A	H7CDD	16 ppb	N/A
25	N/A	OCDD	25 ppb	N/A
25	0.04 ppb	TCDD	ND	N/A
25	N/A	H6CDD	0.23 ppb	N/A
25	N/A	H7CDD	0.67 ppb	N/A
25	N/A	OCDD	0.89 ppb	N/A
25	0.2 ppb	2,3,7,8 TCDD	0.6 ppb	N/A
25	0.40 ppb	TCDD	1.0 ppb	N/A
25	N/A	H6CDD	34 ppb	N/A
25	N/A	H7CDD	430 ppb	N/A
25	N/A	OCDD	1300 ppb	N/A
38	1 ppt	TCDD	ND	N/A
38	N/A	TCDD	170 ppt	N/A
38	3 ppt	H6CDD	ND	N/A
38	N/A	H6CDD	260 ppt	N/A
38	2 ppt	H7CDD	ND	N/A
38	N/A	H7CDD	330 ppt	N/A
38	14 ppt	OCDD	ND	N/A
38	N/A	OCDD	210 ppt	N/A
38	N/A	2,3,7,8 TCDD	26 ppt	N/A
38	N/A	TCDD	777 ppt	N/A
38	N/A	H6CDD	3100 ppt	N/A
38	N/A	H7CDD	7200 ppt	N/A
38	N/A	OCDD	10600 ppt	N/A

DOMESTIC SOURCES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Wood	Dow Chemical	G
25	Natural Gas	Dow Chemical	G
25	Natural Gas	Dow Chemical	G
25	Natural Gas	Dow Chemical	G
25	Natural Gas	Dow Chemical	G
25	Natural Gas	Dow Chemical	G
38	Oil	Dow Chemical	G
38	Wood	Dow Chemical	G
38	Oil	Dow Chemical	G
38	Wood	Dow Chemical	G
38	Oil	Dow Chemical	G
38	Wood	Dow Chemical	G
38	Oil	Dow Chemical	G
38	Wood	Dow Chemical	G
38	Oil, Wood	Dow Chemical	G
38	Oil, Wood	Dow Chemical	G
38	Oil, Wood	Dow Chemical	G
38	Oil, Wood	Dow Chemical	G
38	Oil, Wood	Dow Chemical	G

FOSSIL FUEL COMBUSTION

REF #	SOURCE TYPE	FACILITY
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
8	FOSSIL FUEL	(7) Coal-fired Utility Plants
25	FOSSIL FUEL	Midland Mich.
25	FOSSIL FUEL	Midland Mich.
25	FOSSIL FUEL	Midland Mich.
25	FOSSIL FUEL	Midland Mich.
25	FOSSIL FUEL	Midland Mich.
28	FOSSIL FUEL	N/A
29	FOSSIL FUEL	N/A
30	FOSSIL FUEL	U.S.

FOSSIL FUEL COMBUSTION

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
8	Large PC Boiler	ESP	FG
8	Large PC Boiler	Stack	FG
8	Large PC Boiler	Stack	FA
8	Large PC Boiler	Feed	FG
8	Large PC Boiler	ESP	FA
8	Large PC Boiler	Feed	FG
8	Large PC Boiler	Feed	FA
8	Large PC Boiler	Stack	FA
8	Large PC Boiler	ESP	FA
8	Large PC Boiler	Stack	FG
8	Large PC Boiler	Feed	FA
8	Large PC Boiler	ESP	FG
25	Power house	Stack	FA
25	Power house	Stack	FA
25	Power house	Stack	FA
25	Power house	Stack	FA
25	Power house	Stack	FA
28	One Plant	Stack	FA
29	One Plant	N/A	FA
30	N/A	N/A	FA

FOSSIL FUEL COMBUSTION

REF #	METHOD	SAMPLE NUM.	EXTRACTION
8	MM5T	5 Days	Soxhlet/Benzene
8	MM5T	5 Days	Soxhlet/Benzene
8	GS	5 Days	Soxhlet/Benzene
8	MM5T	5 Days	Soxhlet/Benzene
8	GS	5 Days	Soxhlet/Benzene
8	MM5T	5 Days	Soxhlet/Benzene
8	GS	5 Days	Soxhlet/Benzene
8	GS	5 Days	Soxhlet/Benzene
8	GS	5 Days	Soxhlet/Benzene
8	MM5T	5 Days	Soxhlet/Benzene
8	GS	5 Days	Soxhlet/Benzene
8	MM5T	5 Days	Soxhlet/Benzene
25	GS	N/A	N/A
25	GS	N/A	N/A
25	GS	N/A	N/A
25	GS	N/A	N/A
25	GS	N/A	N/A
28	N/A	N/A	Hexane/Acetone
29	GS	1 Sample	Basic Extraction
30	GS	7 samples	Soxhlet/Benzene(24 hr)

FOSSIL FUEL COMBUSTION

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
8	HRGC/MS	PPT	PCDD
8	HRGC/MS	PPT	PCDF
8	HRGC/MS	PPT	PCDD
8	HRGC/MS	PPT	PCDD
8	HRGC/MS	PPT	PCDD
8	HRGC/MS	PPT	PCDF
8	HRGC/MS	PPT	PCDD
8	HRGC/MS	PPT	PCDF
8	HRGC/MS	PPT	PCDF
8	HRGC/MS	PPT	PCDD
8	HRGC/MS	PPT	PCDF
8	HRGC/MS	PPT	PCDF
25	GC/MS	10 ppb	2,3,7,8 TCDD
25	GC	N/A	H6CDD
25	GC/MS	20 ppb	TCDD
25	GC	N/A	H7CDD
25	GC	N/A	OCDD
28	GC/MS	1.2 ppt	TCDD
29	GC/MS	N/A	TCDD
30	GC/MS	2 ppt	TCDD

FOSSIL FUEL COMBUSTION

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
8	ND	N/A	Coal
25	ND	N/A	coal and oil
25	2 ppb	N/A	coal and oil
25	38 ppb	N/A	coal and oil
25	4 ppb	N/A	coal and oil
25	24 ppb	N/A	coal and oil
28	ND	N/A	Low Sulfur Coal
29	ND	N/A	Coal
30	ND	N/A	Coal

FOSSIL FUEL COMBUSTION

REF #	SAMPLING ORGANIZATION	RATING
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
8	MRI	G
25	Dow Chemical	G
25	Dow Chemical	G
25	Dow Chemical	G
25	Dow Chemical	G
25	Dow Chemical	G
28	Univ. of Calif. at Davis	G
29	Batelle, Columbus Lab	I
30	U.S. EPA	G

REF #	SOURCE TYPE	FACILITY
25	AUTO MUFFLERS	Pontiac Mich.
25	AUTO MUFFLERS	Pontiac Mich.
25	AUTO MUFFLERS	Pontiac Mich.
25	AUTO MUFFLERS	Pontiac Mich.
25	AUTO MUFFLERS	Pontiac Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Detroit Mich.
25	AUTO MUFFLERS	Auburn Mich.
25	AUTO MUFFLERS	Auburn Mich.
25	AUTO MUFFLERS	Auburn Mich.
25	AUTO MUFFLERS	Auburn Mich.
25	AUTO MUFFLERS	Saginaw Mich.
25	AUTO MUFFLERS	Saginaw Mich.
25	AUTO MUFFLERS	Saginaw Mich.
25	AUTO MUFFLERS	Saginaw Mich.
25	AUTO MUFFLERS	Saginaw Mich.
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A
*39	AUTO MUFFLERS	N/A

AUTOMOBILE EMISSIONS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHO
25	Reg gas / no Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Reg gas / no Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Reg gas / no Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Reg gas / no Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Reg gas / no Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter / Low mileage	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter / Low mileage	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter / Low mileage	MUFFLER	ASH	SCRAPI
25	Unleaded / Catalytic Converter / Low mileage	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
25	Diesel Truck	MUFFLER	ASH	SCRAPI
*39	Diesel	Muffler	Ash	Scrapi
*39	Diesel	Muffler	Ash	Scrapi
*39	Unleaded	Muffler	Ash	Scrapi
*39	Unleaded	Muffler	Ash	Scrapi
*39	Leaded	Muffler	Ash	Scrapi
*39	Leaded	Muffler	Ash	Scrapi
*39	Chevette-Broken Ring	Muffler	Ash	Scrapi
*39	Chevette-Broken Ring	Muffler	Ash	Scrapi

AUTOMOBILE EMISSIONS

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	EC/GC
25	N/A	N/A	EC/GC
25	N/A	N/A	EC/GC
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
*39	2 Cars	Methylene Chloride/Hexane	HRGC/HRMS
*39	2 Cars	Methylene Chloride/Hexane	HRGC/HRMS
*39	10 cars	Methylene Chloride/Hexane	HRGC/HRMS
*39	10 cars	Methylene Chloride/Hexane	HRGC/HRMS
*39	3 Cars	Methylene Chloride/Hexane	HRGC/HRMS
*39	3 Cars	Methylene Chloride/Hexane	HRGC/HRMS
*39	1 car	Methylene Chloride/Hexane	HRGC/HRMS
*39	1 car	Methylene Chloride/Hexane	HRGC/HRMS

AUTOMOBILE EMISSIONS

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILIT
25	2.0 ppt	2,3,7,8 TCDD	ND	N/A
25	2.0 ppt	TCDD	4.0 ppt	N/A
25	14 ppt	H6CDD	ND	N/A
25	6 ppt	H7CDD	ND	N/A
25	8 ppt	OCDD	16 ppt	N/A
25	2.0 ppt	TCDD	ND	N/A
25	10 ppt	H6CDD	ND	N/A
25	8 ppt	H7CDD	14 ppt	N/A
25	N/A	OCDD	68 ppt	N/A
25	0.1 ppt	TCDD	0.1 ppt	N/A
25	0.1 ppt	H6CDD	0.5 ppt	N/A
25	0.2 ppt	H7CDD	2 ppt	N/A
25	0.5 ppt	OCDD	8 ppt	N/A
25	3.0 ppt	TCDD	ND	N/A
25	25 ppt	H6CDD	ND	N/A
25	30 ppt	H7CDD	110 ppt	N/A
25	N/A	OCDD	280 ppt	N/A
25	1.0 ppt	2,3,7,8 TCDD	3.0 ppt	N/A
25	N/A	TCDD	20 ppt	N/A
25	15 ppt	H6CDD	20 ppt	N/A
25	15 ppt	H7CDD	100 ppt	N/A
25	N/A	OCDD	260 ppt	N/A
*39	40 pg	2,3,7,8 TCDD	ND	N/A
*39	40 pg	TCDD	ND	N/A
*39	40 pg	2,3,7,8 TCDD	0.23 ng	N/A
*39	40 pg	TCDD	6.5 ng	N/A
*39	40 pg	2,3,7,8 TCDD	2 ng	N/A
*39	40 pg	TCDD	36 ng	N/A
*39	40 pg	2,3,7,8 TCDD	0.15 ng	N/A
*39	40 pg	TCDD	4.3 ng	N/A

AUTOMOBILE EMISSIONS

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
25	Regular Gas	Dow Chemical	G
25	Regular Gas	Dow Chemical	G
25	Regular Gas	Dow Chemical	G
25	Regular Gas	Dow Chemical	G
25	Regular Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Unleaded Gas	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
25	Diesel Fuel	Dow Chemical	G
*39	Diesel Fuel	U.S. EPA	G
*39	Diesel Fuel	U.S. EPA	G
*39	Unleaded Gas	U.S. EPA	G
*39	Unleaded Gas	U.S. EPA	G
*39	Leaded Gas	U.S. EPA	G
*39	Leaded Gas	U.S. EPA	G
*39	Unleaded Gas	U.S. EPA	G
*39	Unleaded Gas	U.S. EPA	G

WIRE RECLAMATION INCINERATORS

REF #	SOURCE TYPE	FACILITY
33	WIRE RECLAMATION INCINERATOR	Midwestern USA (1)
33	WIRE RECLAMATION INCINERATOR	Midwestern USA (1)
33	WIRE RECLAMATION INCINERATOR	Midwestern USA (1)
33	WIRE RECLAMATION INCINERATOR	Midwestern USA (1)

WIRE RECLAMATION INCINERATORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METH
33	3 Incinerators	Stack	FA	GS
33	3 Incinerators	Stack	FA	GS
33	3 Incinerators	Furnace	FA	GS
33	3 Incinerators	Furnace	FA	GS

WIRE RECLAMATION INCINERATORS

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
33	N/A	Hexane/Acetone	GC/MS
33	N/A	Hexane/Acetone	GC/MS
33	N/A	Hexane/Acetone	GC/MS
33	N/A	Hexane/Acetone	GC/MS

WIRE RECLAMATION INCINERATORS

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILI
33	N/A	TCDD	41C ppt	N/A
33	N/A	TCDF	11600 ppt	N/A
33	N/A	TCDD	58 ppt	N/A
33	N/A	TCDF	730 ppt	N/A

WIRE RECLAMATION INCINERATORS

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
33	Wire Insul&Con.	EPA	G
33	Wire Insul&Con.	EPA	G
33	Wire Insul&Con.	EPA	G
33	Wire Insul&Con.	EPA	G

THERMAL ACTIVATED CARBON REGENERATION

REF #	SOURCE TYPE	FACILITY
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio
32	CARBON REGENERATION	Cincinnati, Ohio

THERMAL ACTIVATED CARBON REGENERATION

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHO
32	Fluidized Bed System	-----	Feed	GS
32	Fluidized Bed System	-----	Feed	GS
32	Fluidized Bed System	Cyclone	Ash	GS
32	Fluidized Bed System	Cyclone	Ash	GS
32	Fluidized Bed System	Scrubber	Water	GS
32	Fluidized Bed System	Scrubber	Water	GS
32	Fluidized Bed System	Quench	Water	GS
32	Fluidized Bed System	Quench	Water	GS
32	Fluidized Bed System	Stack	FA	MM5T
32	Fluidized Bed System	Stack	FA	MM5T
32	Fluidized Bed System	Stack	FG	MM5T
32	Fluidized Bed System	Stack	FG	MM5T

THERMAL ACTIVATED CARBON REGENERATION

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS
32	4 Tests/3 Days	Soxhlet/Methylene Chloride	HRGC/HRMS

THERMAL ACTIVATED CARBON REGENERATION

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILIT
32	N/A	2,3,7,8 TCDD	ND	N/A
32	N/A	TCDD	ND	N/A
32	N/A	2,3,7,8 TCDD	ND	N/A
32	N/A	TCDD	1.11 ppt	0.2 - 4.1 ppt
32	N/A	2,3,7,8 TCDD	.03 ppt	ND - .07 ppt
32	N/A	TCDD	.075 ppt	ND - .2 ppt
32	N/A	2,3,7,8 TCDD	ND	N/A
32	N/A	TCDD	ND	N/A
32	N/A	2,3,7,8 TCDD	.083 ppt	.01 - .2 ppt
32	N/A	TCDD	.138 ppt	.05 - .2 ppt
32	N/A	2,3,7,8 TCDD	.0025 ppt	ND - .01 ppt
32	.04 - 2.0 mg/Kg	TCDD	.0125 ppt	ND - .05 ppt

THERMAL ACTIVATED CARBON REGENERATION

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I
32	Spent Activated Carb	Batelle Labs	I

SEWAGE SLUDGE INCINERATORS

EF #	SOURCE TYPE	FACILITY
27	SEWAGE SLUDGE INCINERATORS	Ontario
27	SEWAGE SLUDGE INCINERATORS	Ontario

SEWAGE SLUDGE INCINERATORS

EF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METH
27	Multiple Hearth Inc. (1000 C)	Stack	N/A	N/A
27	Multiple Hearth Inc. (1000 C)	Stack	N/A	N/A

SEWAGE SLUDGE INCINERATORS

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
27	3 Sample Periods	N/A	N/A
27	3 Sample Periods	N/A	N/A

SEWAGE SLUDGE INCINERATORS

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILI
27	N/A	PCDD	0.739 ug/m3	.483 - 1.14 ug/
27	N/A	PCDF	1.213 ug/m3	.501 - 2.248 ug

SEWAGE SLUDGE INCINERATORS

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
27	Sewage Sludge	Ont. Ministry of Env.	1
27	Sewage Sludge	Ont. Ministry of Env.	1

BOILERS COFIRING WASTES

REF #	SOURCE TYPE	FACILITY
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	SITE G
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	SITE E
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	Site A
20	IND WASTE BOILERS	SITE D
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
22	IND WASTE BOILERS	N/A
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
23	IND WASTE BOILER	European
24	IND WASTE BOILER	Bay City, Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	TAR BURNER	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	TAR BURNER	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	TAR BURNER	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	TAR BURNER	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
25	INDUSTRIAL SW INCINERATION	Midland Mich.
76	WASTE OIL BOILER	Aarqu, Switzerland
76	WASTE OIL BOILER	Aarqu, Switzerland
*87	WASTE OIL BOILER	Greenhouse

BOILERS COFIRING WASTES

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METH
20	Keeler CP Steam Generator	Stack	FG/FA	MM5
20	Keeler CP Steam Generator	Stack	FG/FA	MM5
20	Fire Tube Boiler	Stack	FG/FA	MM5
20	Keeler CP Steam Generator	Furnace	Ash	GS
20	Keeler CP Steam Generator	-----	Feed	GS
20	Keeler CP Steam Generator	Furnace	Ash	GS
20	Water Tube Boiler	Stack	FG/FA	MM5
20	Keeler CP Steam Generator	Stack	FG/FA	MM5
20	Keeler CP Steam Generator	-----	Feed	GS
20	B&W Wall-Fired Boiler	Stack	FG/FA	MM5
22	Industrial Boiler (pile burner)	Feed	Sludge	GS
22	Industrial Boiler (pile burner)	Composit	Ash	GS
22	Industrial Boiler (pile burner)	Feed	Sludge	GS
22	Industrial Boiler (pile burner)	Composit	Ash	GS
22	Industrial Boiler (pile burner)	Composit	Ash	GS
22	Industrial Boiler (pile burner)	Stack	FG	Trai
22	Industrial Boiler (pile burner)	Feed	Sludge	GS
22	Industrial Boiler (pile burner)	Feed	Sludge	GS
22	Industrial Boiler (pile burner)	Composit	Ash	GS
23	Ind BOILER (PCP WASTES)	Furnace	Ash	GS
23	Ind BOILER (PCP WASTES)	Baghouse	Ash	GS
23	Ind BOILER (PCP WASTES)	Baghouse	Ash	GS
23	Ind BOILER (PCP WASTES)	Furnace	Ash	GS
23	Ind BOILER (PCP WASTES)	Baghouse	Ash	GS
23	Ind BOILER (PCP WASTES)	Furnace	Ash	GS
23	Ind BOILER (PCP WASTES)	Furnace	Ash	GS
23	Ind BOILER (PCP WASTES)	Baghouse	Ash	GS
24	High Eff. Ind. Boiler	Stack	FG/FA	MM5
25	Rotary kiln with suppl. fuel	Scrubber	FA	FILTE
25	Rotary kiln with suppl. fuel	Scrubber	FA	FILTE
25	Rotary kiln without suppl. fuel	Stack	FA	GS
25	Rotary kiln with suppl. fuel	Scrubber	FA	FILTE
25	Rotary kiln with suppl. fuel	Stack	FA	GS
25	Rotary kiln with suppl. fuel	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Stack	FA	GS
25	Rotary kiln with suppl. fuel	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Scrubber	FA	FILTER
25	72 million BTU/hr with supplemental fuel (gas)	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Scrubber	FA	FILTE
25	72 million BTU/hr with supplemental fuel (gas)	Stack	FA	GS
25	Rotary kiln with suppl. fuel	Scrubber	FA	FILTE
25	72 million BTU/hr with supplemental fuel (gas)	Stack	FA	GS
25	Rotary kiln with suppl. fuel	Stack	FA	GS
25	72 million BTU/hr with supplemental fuel (gas)	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Scrubber	FA	FILTE
25	Rotary kiln without suppl. fuel	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Scrubber	FA	FILTE
25	Rotary kiln with suppl. fuel	Stack	FA	GS
25	Rotary kiln without suppl. fuel	Stack	FA	GS
76	N/A	Stack/ESP	FA	N/A
76	N/A	Stack/ESP	FA	N/A
*87	Four Pass Fire Tube	Stack	FG	MM5

BOILERS COFIRING WASTES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	N/A	Soxhlet/Methylene Chloride	HRGC/HRMS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	N/A	Soxhlet/Methylene Chloride	HRGC/HRMS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	4 Tests	Soxhlet/Methylene Chloride	HRGC/HRMS
20	N/A	Soxhlet/Methylene Chloride	HRGC/HRMS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
22	5 Days	N/A	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
23	N/A	Soxhlet/Toluene	GC/MS
24	3	Soxhlet/Methylene Chloride	GC/MS
25	N/A	N/A	GC/MS
25	N/A	N/A	GC/MS
25	4 samples	N/A	GC/MS
25	N/A	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	4 samples	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	N/A	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	N/A	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	N/A	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	N/A	N/A	GC/MS
25	4 samples	N/A	GC/MS
25	4 samples	N/A	GC/MS
25	N/A	N/A	GC/MS
25	5 samples	N/A	GC/MS
25	4 samples	N/A	GC/MS
76	N/A	Methylene Chloride	GC/MS
76	N/A	Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet Methylene Chloride	GC/MS

BOILERS COFIRING WASTES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILI
20	0.4 ng/m3	TCDD	40.5 ng/m3	38 - 43 ng/m3
20	0.4 ng/m3	PCDD	75.5 ng/m3	75 - 76 ng/m3
20	1000 ng/m3	PCDD	ND	N/A
20	0.02 ppb	2,3,7,8 TCDD	ND	N/A
20	0.6 ppb	TCDD	ND	N/A
20	0.02 ppb	PCDD	51.5 ppb	38 - 65 ppb
20	1000 ng/m3	PCDD	ND	N/A
20	0.4 ng/m3	2,3,7,8 TCDD	ND	N/A
20	0.6 ppb	PCDD	6.85 ppm	N/A
20	1000 ng/m3	PCDD	ND	N/A
22	0.05 ng/g	TCDF	ND	N/A
22	5.5 ng/g	PCDF	92.1 ng/g	37.8 - 124.4 ng
22	5.75 ng/g	PCDF	18.2 ng/g	N/A
22	5.2 ng/g	PCDD	209 ng/g	30.5 - 439.4 ng
22	0.2 ng/g	TCDD	2.5 ng/g	0.8 - 3.4 ng/
22	10 ng/m3	PCDD/PCDF	ND	N/A
22	0.9 ng/g	TCDD	ND	N/A
22	6.4 ng/g	PCDD	306 ng/g	N/A
22	0.5 ng/g	TCDF	3.7 ng/g	1.2 - 7 ng/g
23	N/A	PCDF	ND	N/A
23	N/A	PCDF	2.6 ug/g	N/A
23	N/A	TCDF	0.90 ug/g	N/A
23	N/A	TCDF	ND	N/A
23	N/A	PCDD	5.2 ug/g	N/A
23	N/A	TCDD	0.31 ug/g	N/A
23	N/A	PCDD	0.01 ug/g	N/A
23	N/A	TCDD	0.96 ug/g	N/A
24	N/A	PCDD/PCDF	ND	N/A
25	N/A	H6CDD	200 ppb	N/A
25	N/A	H7CDD	970 ppb	N/A
25	N/A	OCDD	263000 ppb	3000 - 810000 p
25	N/A	OCDD	1200 ppb	N/A
25	2.0 ppb	TCDD	ND	N/A
25	0.5 ppb	H6CDD	2.1 ppb	ND - 5.0 ppb
25	N/A	H6CDD	21225 ppb	1300 - 65000 p
25	N/A	H7CDD	32 ppb	4.0 - 110.0 pp
25	N/A	TCDD	2500 ppb	N/A
25	1.5 ppb	TCDD	ND	ND
25	N/A	H7CDD	26000 ppb	N/A
25	N/A	H6CDD	7.6 ppb	1 - 20 ppb
25	N/A	TCDD	46 ppb	N/A
25	N/A	H7CDD	91 ppb	27 - 160 ppb
25	2.0 ppb	2,3,7,8 TCDD	ND	N/A
25	N/A	OCDD	306 ppb	190 - 440 ppb
25	N/A	H6CDD	3400 ppb	N/A
25	N/A	2,3,7,8 TCDD	55 ppb	ND - 110 ppb
25	N/A	H7CDD	164750 ppb	2000 - 510000 p
25	N/A	OCDD	42000 ppb	N/A
25	N/A	OCDD	234.8 ppb	9.0 - 950.0 pp
25	N/A	TCDD	7705 ppb	3410 - 12000 p
76	N/A	PCDF	0.3 ppm	N/A
76	N/A	PCDD	0.6 ppm	N/A
*87	.05 - 3.1 ug/m3	PCDF	.232 ug/m3	ND - .73 ug/m

BOILERS COFIRING WASTES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
20	Waste Wood	Acurex	G
20	Waste Wood	Acurex	G
20	CL-Wastes	Acurex	G
20	Waste Wood	Acurex	G
20	Waste Wood	Acurex	G
20	Waste Wood	Acurex	G
20	CL-Waste Oil	Acurex	G
20	Waste Wood	Acurex	G
20	Waste Wood	Acurex	G
20	CL-Solvents	Acurex	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
22	PCP / scrap wood	Acurex Corp.	G
23	PCP	Univ. of Umea, Sweden	I
23	PCP	Univ. of Umea, Sweden	G
23	PCP	Univ. of Umea, Sweden	G
23	PCP	Univ. of Umea, Sweden	I
23	PCP	Univ. of Umea, Sweden	G
23	PCP	Univ. of Umea, Sweden	G
23	PCP	Univ. of Umea, Sweden	G
23	PCP	Univ. of Umea, Sweden	G
24	PCBs (500 ppm)	GCA	I
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	gas and tars	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	gas and tars	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	gas and tars	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	gas and tars	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
25	tars, SW, gas	Dow Chemical	G
76	Used Ind. Oil	Swiss Fed. Res. Station	I
76	Used Ind. Oil	Swiss Fed. Res. Station	I
*87	Spiked Waste Oil	EPA/GCA Corp	P

BOILERS COFIRING WASTES

REF #	SOURCE TYPE	FACILITY
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse Complex
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse Complex
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Greenhouse Complex
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Greenhouse Complex
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse Complex
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Greenhouse
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Office Building
*87	WASTE OIL BOILER	Office Building

BOILERS COFIRING WASTES

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METH
*87	Three Pass Fire Tube	Stack	FG	MM5
*87	Four Pass Fire Tube	Stack	FG	MM5
*87	Three Pass Fire Tube	Stack	FG	MM5
*87	Four Pass Fire Tube	-----	Feed	GS
*87	Four Pass Scotch Fire Tube	-----	Feed	GS
*87	Three Pass Scotch Fire Tube	-----	Feed	GS
*87	Four Pass Scotch Fire Tube	Stack	FG	MM5
*87	Three Pass Scotch Fire Tube	Stack	FG	MM5
*87	Four Pass Scotch Fire Tube	Stack	FG	MM5
*87	Three Pass Scotch Fire Tube	Fire Tube	FA	GS
*87	Horizontal Return Tube Boiler	Stack	FG	MM5
*87	Three Pass Scotch Fire Tube	Fire Tube	FA	GS
*87	Horizontal Return Tube Boiler	Stack	FG	MM5
*87	Three Pass Fire Tube	-----	Feed	GS
*87	Horizontal Return Tube Boiler	Stack	FG	MM5
*87	Four Pass Fire Tube	Stack	FG	MM5
*87	Horizontal Return Tube Boiler	Stack	FG	MM5
*87	Three Pass Scotch Fire Tube	Stack	FG	MM5
*87	Horizontal Return Tube Boiler	-----	Feed	GS
*87	Three Pass Scotch Fire Tube	Fire Tube	FA	GS
*87	Cast Iron Boiler	Stack	FG	MM5
*87	Three Pass Fire Tube	Stack	FG	MM5
*87	Cast Iron Boiler	Stack	FG	MM5
*87	Three Pass Scotch Fire Tube	Stack	FG	MM5
*87	Four Pass Fire Tube	Stack	FG	MM5
*87	Three Pass Scotch Fire Tube	Fire Tube	FA	GS
*87	Cast Iron Boiler	Stack	FG	MM5
*87	Cast Iron Boiler	-----	Feed	GS

BOILERS COFIRING WASTES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	4 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	N/A	Soxhlet/Methylene Chloride	GC/MS
*87	4 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	4 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	3 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	2 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	3 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	2 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	2 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	2 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	2 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	3 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet Methylene Chloride	GC/MS
*87	3 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS
*87	6 Trials	Soxhlet/Methylene Chloride	GC/MS

BOILERS COFIRING WASTES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABIL
*87	0.10 ug/m3	TCDD	ND	N/A
*87	.05 - 3.1 ug/m3	PCDD	0.32 ug/m3	ND - 1.6 ug/m
*87	.05 - 3.0 ug/m3	PCDF	0.42 ug/m3	ND - 2.1 ug/m
*87	.04 - 2.0 mg/kg	PCDD/PCDF	ND	N/A
*87	.04 - 2.0 mg/kg	PCDD/PCDF	ND	N/A
*87	0.04 - 2.0 mg/kg	PCDD/PCDF	ND	N/A
*87	0.04 - 3.0 ug/m3	PCDD	0.35 ug/m3	ND - 1.4 ug/m
*87	0.05 - 4.0 ug/m3	PCDF	0.416 ug/m3	ND - .75 ug/m
*87	0.04 - 3.0 ug/m3	PCDF	ND	N/A
*87	0.5 - 10.0 ug/kg	PCDD	337 ug/kg	ND - 583 ug/k
*87	0.06 ug/m3	TCDF	ND	N/A
*87	0.5 - 10 ug/kg	PCDF	1267 ug/kg	71 - 2,200 ug/
*87	0.05 - 2.0 ug/m3	PCDF	0.78 ug/m3	0.69 - 0.86 ug/
*87	.04 - 2.0 mg/kg	PCDD/PCDF	ND	N/A
*87	0.06 ug/m3	TCDD	ND	N/A
*87	.09 ug/m3	TCDD	ND	N/A
*87	.05 - 4.5 ug/m3	PCDD	2.48 ug/m3	0.45 - 4.5 ug/
*87	0.05 - 4.0 ug/m3	PCDD	ND	N/A
*87	.04 - 2.0 mg/kg	PCDD/PCDF	ND	N/A
*87	0.5 ug/kg	TCDD	ND	N/A
*87	0.5 - 3.1 ug/m3	PCDF	1.3 ug/m3	N/A
*87	.05 - 3.0 ug/m3	PCDD	-----	ND - 17 ug/m3
*87	0.10 ug/m3	TCDF	ND	N/A
*87	0.12 ug/m3	TCDF	ND	N/A
*87	0.09 ug/m3	TCDF	0.034 ug/m3	ND - .17 ug/m
*87	0.5 ug/kg	TCDF	177 ug/kg	11 - 350 ug/k
*87	.05 - 3.1 ug/m3	PCDD	ND	N/A
*87	.04 - 2.0 mg/kg	PCDD/PCDF	ND	N/A

BOILERS COFIRING WASTES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P
*87	Spiked Waste Oil	EPA/GCA Corp	P

EXPERIMENTAL STUDIES

REF #	SOURCE TYPE	FACILITY
25	EXPERIMENTAL	N/A
25	EXPERIMENTAL	N/A
25	EXPERIMENTAL	N/A
25	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
31	EXPERIMENTAL	N/A
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
37	EXPERIMENTAL	Pilot Incineration
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHOD
25	Cigarette Smoke	N/A	SMOKE	FILTER
25	Cigarette Smoke	N/A	SMOKE	FILTER
25	Cigarette Smoke	N/A	SMOKE	FILTER
25	Cigarette Smoke	N/A	SMOKE	FILTER
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	Feed	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
31	quartz tube (600 C)	N/A	FG	Wool Tra
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	-----	Feed	GS
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	-----	Feed	GS
37	Chlorophenol Treated Wood	-----	Feed	GS
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	-----	Feed	GS
37	Chlorophenol Treated Wood	-----	Feed	GS
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	N/A	FG	Glass Wo
37	Chlorophenol Treated Wood	-----	Feed	GS
37	Chlorophenol Treated Wood	-----	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. Fi
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 Fi
40	Chlorophenate Pyrolysis	N/A	Ash	GS
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 Fi
40	Chlorophenate Pyrolysis	N/A	Ash	GS
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 Fi
40	Chlorophenate Pyrolysis	N/A	Ash	GS

EXPERIMENTAL STUDIES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
25	2 Tests	Hexane	GC/MS
25	2 Tests	Hexane	GC/MS
25	2 Tests	Hexane	GC/MS
25	2 Tests	Hexane	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
31	N/A	Soxhlet/Benzene	GC/MS
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
37	5 Tests	Soxhlet/Benzene	Mass Frag.
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS

EXPERIMENTAL STUDIES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILITY
25	N/A	H7CDD	8.5, 9.0 pg/cigarett	N/A
25	N/A	OCDD	50, 18 pg/cigarette	N/A
25	10 pg/cigarette	TCDD	ND	N/A
25	N/A	H6CDD	8.0, 4.2 pg/cigarett	N/A
31	0.5 ppb	OCDD	2.7 ng/g feed	N/A
31	0.3 ppb	H7CDD	25 ng/g feed	N/A
31	0.03 ppb	OCDD	ND	N/A
31	0.03 ppb	H7CDD	ND	N/A
31	0.1 ppb	H6CDD	8.4 ng/g feed	N/A
31	0.01 ppb	H6CDD	ND	N/A
31	0.2 ppb	H6CDD	ND	N/A
31	0.003	TCDD	ND	N/A
31	0.7 ppb	OCDD	1.3 ng/g feed	N/A
31	0.3 ppb	OCDD	ND	N/A
31	0.1 ppb	H6CDD	ND	N/A
31	0.1 ppb	H7CDD	ND	N/A
31	0.5 ppb	OCDD	ND	N/A
31	0.03 ppb	H6CDD	ND	N/A
31	0.2 ppb	H6CDD	ND	N/A
31	0.07 ppb	TCDD	ND	N/A
31	0.06 ppb	TCDD	1.4 ng/g feed	N/A
31	0.6 ppb	OCDD	64 ng/g geed	N/A
31	0.07 ppb	TCDD	ND	N/A
31	0.3 ppb	TCDD	1.2 ng/g feed	N/A
31	0.08 ppb	TCDD	ND	N/A
31	0.4 ppb	H6CDD	29 ng/g feed	N/A
31	0.07 ppb	TCDD	ND	N/A
31	2 ppb	H7CDD	91 ng/g feed	N/A
31	0.3 ppb	H7CDD	0.6 ng/g feed	N/A
31	0.2 ppb	H7CDD	0.5 ng/g feed	N/A
31	0.3 ppb	H7CDD	ND	N/A
31	3 ppb	OCDD	290 ng/g feed	N/A
37	N/A	PCDD	131.2 ug/g feed	6.2 - 385 ug/g fee
37	N/A	TCDD	0.2 ug/g feed	N/A
37	N/A	PCDD	346 ug/g feed	31-854 ug/g feed
37	N/A	PCDD	15.44 ug/g feed	.9 - 41 ug/g feed
37	N/A	TCDD	52.5 ug/g feed	10-140 ug/g feed
37	N/A	PCDD	12.3 ug/g feed	N/A
37	N/A	PCDD	6.4 ug/g feed	N/A
37	N/A	TCDD	ND	N/A
37	N/A	TCDD	0.4 ug/g feed	N/A
37	N/A	TCDD	0.7 ug/g feed	N/A
37	N/A	TCDD	69.9 ug/g feed	1.8 - 230 ug/g fee
37	N/A	PCDD	0.296 ug/g feed	ND - 0.8 ug/g fee
37	N/A	TCDD	0.44 ug/g feed	ND - 2 ug/g feed
37	N/A	PCDD	2.4 ug/g feed	N/A
37	N/A	PCDD	11 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	80 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	347 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	17 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	29 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	58 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	1.2 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	18 ug/g feed	N/A

EXPERIMENTAL STUDIES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
25	Tobacco	Dow Chemical	G
25	Tobacco	Dow Chemical	G
25	Tobacco	Dow Chemical	G
25	Tobacco	Dow Chemical	G
31	Coal + Air + NaC1	Dow Chemical	G
31	Coal + Air + HC1	Dow Chemical	G
31	Feed/HCl	Dow Chemical	G
31	Feed/HCl	Dow Chemical	G
31	Coal + Air + HC1	Dow Chemical	G
31	Feed/HCl	Dow Chemical	G
31	Coal + Air + NaC1	Dow Chemical	G
31	Feed/HCl	Dow Chemical	G
31	Coal + Air	Dow Chemical	G
31	Feed/Coal	Dow Chemical	G
31	Coal + Air	Dow Chemical	G
31	Feed/Coal	Dow Chemical	G
31	C12 + Air	Dow Chemical	G
31	Feed/Coal	Dow Chemical	G
31	C12 + Air	Dow Chemical	G
31	Feed/Coal	Dow Chemical	G
31	Coal + Air + HC1	Dow Chemical	G
31	Coal + Air + HC1	Dow Chemical	G
31	Coal + Air + NaC1	Dow Chemical	G
31	Coal + Air + C12	Dow Chemical	G
31	Coal + Air	Dow Chemical	G
31	Coal + Air + C12	Dow Chemical	G
31	C12 + Air	Dow Chemical	G
31	Coal + Air + C12	Dow Chemical	G
31	Coal + Air	Dow Chemical	G
31	Coal + Air + NaC1	Dow Chemical	G
31	C12 + Air	Dow Chemical	G
31	Coal + Air + C12	Dow Chemical	G
37	K trichlorophenolate	Univ. of Stockholm	G
37	Tetrachlorophenolate	Univ. of Stockholm	G
37	Na Tetrachlorophenol	Univ. of Stockholm	G
37	Pentachlorophenol	Univ. of Stockholm	G
37	Na Tetrachlorophenol	Univ. of Stockholm	G
37	Pentachlorophenol	Univ. of Stockholm	G
37	Na Tetrachlorophenol	Univ. of Stockholm	G
37	Tetrachlorophenolate	Univ. of Stockholm	I
37	Na Tetrachlorophenol	Univ. of Stockholm	G
37	K trichlorophenolate	Univ. of Stockholm	G
37	K trichlorophenolate	Univ. of Stockholm	G
37	Tetrachlorophenolate	Univ. of Stockholm	G
37	Pentachlorophenol	Univ. of Stockholm	G
37	Tetrachlorophenolate	Univ. of Stockholm	G
37	K trichlorophenolate	Univ. of Stockholm	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G

EXPERIMENTAL STUDIES

REF #	SOURCE TYPE	FACILITY
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
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40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
40	EXPERIMENTAL	Open Fire
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator
41	EXPERIMENTAL	Pilot Scale Incinerator

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHO
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	Ash	GS
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	Feed	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	XAD-2 F
40	Chlorophenate Pyrolysis	N/A	Ash	GS
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
40	Chlorophenate Pyrolysis	N/A	FG	Char. F
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A
41	Treated Wood	N/A	FG	N/A

EXPERIMENTAL STUDIES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
40	N/A	Soxhlet/Methylene Chloride	GC/MS
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A
41	5 Trials	N/A	N/A

EXPERIMENTAL STUDIES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILITY
40	0.01 - 0.20 ug/g	TCDD	0.4 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	6.4 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	3.5 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	59 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	5.3 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	8 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	2.1 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	96 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	0.3 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	110 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	30 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	1.2 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	84 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	210 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	82 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	35 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	8.2 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	5.6 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	0.4 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	5.2 ug/g feed	N/A
40	0.01 - 0.20 ug/g	PCDD	ND	N/A
40	0.01 - 0.20 ug/g	OCDD	0.3 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	2100 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	357 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	5.0 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	57 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	1.0 ug.g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	120 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	3.0 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	8 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	6.0 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	0.7 ug/g feed	N/A
40	0.01 - 0.20 ug/g	PCDD	ND	ND - 0.9 ug/g fee
40	0.01 - 0.20 ug/g	TCDD	0.7 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	5.2 ug/g feed	N/A
40	0.01 - 0.20 ug/g	TCDD	26 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	14 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	65 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	56 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	9.5 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H7CDD	172 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	0.2 ug/g feed	N/A
40	0.01 - 0.20 ug/g	H6CDD	74 ug/g feed	N/A
40	0.01 - 0.20 ug/g	P5CDD	90 ug/g feed	N/A
40	0.01 - 0.20 ug/g	OCDD	710 ug/g feed	N/A
41	N/A	TCDD	52.5 ug/g feed	10 - 140 ug/g fee
41	N/A	H6CDD	3.92 ug/g feed	ND - 9 gu/g feed
41	N/A	P5CDD	34.72 ug/g feed	1.2 - 81 ug/g fee
41	N/A	H7CDD	1.72 ug/g feed	ND - 8 ug/g feed
41	N/A	H6CDD	154.4 ug/g feed	17 - 360 ug/g fee
41	N/A	OCDD	1.32 ug/g feed	ND - 6 ug/g feed
41	N/A	OCDD	ND	N/A
41	N/A	H7CDD	45.5 ug/g feed	10 - 95 ug/g feed
41	N/A	P5CDD	97.8 ug/g feed	14 - 240 ug/g fee
41	N/A	TCDD	69.86 ug/g feed	2.4 - 230 ug/g fee

EXPERIMENTAL STUDIES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
40	kY - 5	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	kY - 5	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	kY - 5	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	kY - 5	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	kY - 5	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	KY - 5/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	KY - 5/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	KY - 5/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	KY - 5/Birch	Univ. of Umea, Sweden	G
40	SERVAREX	Univ. of Umea, Sweden	G
40	KY - 5/Birch	Univ. of Umea, Sweden	G
40	SERVAREX	Univ. of Umea, Sweden	G
40	2,4,6-Tri-Cl-Phenate	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	2,4,6-Tri-Cl-Phenate	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	2,4,6-Tri-Cl-Phenate	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	2,4,6-Tri-Cl-Phenate	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	2,4,6-Tri-Cl-Phenate	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	2,4,6-Tri-Cl-Phenate	Univ. of Umea, Sweden	G
40	SERVAREX	Univ. of Umea, Sweden	G
40	Pentachlorophenate	Univ. of Umea, Sweden	G
40	SERVAREX	Univ. of Umea, Sweden	G
40	Pentachlorophenate	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	Pentachlorophenate	Univ. of Umea, Sweden	G
40	SERVAREX/Wood Wool	Univ. of Umea, Sweden	G
40	Pentachlorophenate	Univ. of Umea, Sweden	G
40	SERVAREX	Univ. of Umea, Sweden	G
40	Pentachlorophenate	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	SERVAREX/Birch	Univ. of Umea, Sweden	G
40	Pentachlorophenate	Univ. of Umea, Sweden	G
41	Tetrachlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Trichlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Trichlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Trichlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Tetrachlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Trichlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Tetrachlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Tetrachlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Tetrachlorophenolate	Swed. W & A Poll. Res. Inst.	I
41	Trichlorophenolate	Swed. W & A Poll. Res. Inst.	I

EXPERIMENTAL STUDIES

REF #	SOURCE TYPE	FACILITY
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
42	EXPERIMENTAL	N/A
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
43	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
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45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
45	EXPERIMENTAL	Quartz Mini Ampoules
46	EXPERIMENTAL	Quartz Mini Ampoules
48	EXPERIMENTAL	Quartz Tube
48	EXPERIMENTAL	Quartz Tube
48	EXPERIMENTAL	Quartz Tube
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
49	EXPERIMENTAL	Vegetable Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHOD
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
42	Open Fire/Treated Wood	Open Fire	Smoke	Filter
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
43	Trichlorobenzene pyrolysis	N/A	FG	N/A
45	PCB Pyrolysis (650 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (700 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (650 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (600 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (650 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (850 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (700 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (550 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (600 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (550 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (550 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (700 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (850 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (600 degrees C)	N/A	FG	N/A
45	PCB Pyrolysis (850 degrees C)	N/A	FG	N/A
46	PCB Pyrolysis	N/A	FG	N/A
48	Virgin Pine	N/A	FG	XAD-2 Tr
48	Pine and HCl	N/A	FG	XAD-2 Tr
48	Pine and HCl	N/A	FG	XAD-2 Tr
49	Mimosa	N/A	FG	N/A
49	Fruit/Vegetables	N/A	FG	N/A
49	Chestnuts	N/A	FG	N/A
49	Fruit/Vegetables	N/A	FG	N/A
49	Mimosa	N/A	FG	N/A
49	All Vegetables Tested	N/A	FG	N/A
49	Mimosa	N/A	FG	N/A
49	Chestnuts	N/A	FG	N/A
49	Fruit/Vegetables	N/A	FG	N/A
49	Chestnuts	N/A	FG	N/A
49	Chestnuts	N/A	FG	N/A
49	Mimosa	N/A	FG	N/A
49	Fruit/Vegetables	N/A	FG	N/A
52	900 C, 0.67 sec	Lab Furn	FG	Meth Tra
52	700 C, 15	Lab Furn	FG	Meth Tra
52	900 C, 35	Lab Furn	FG	Meth Tra

EXPERIMENTAL STUDIES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
42	8 Experiments	Basic Extraction	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
43	N/A	Benzene	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
45	N/A	Benzene/Hexane	GC/MS
46	N/A	Benzene	GC/MS
48	N/A	N/A	GC/MS
48	N/A	N/A	GC/MS
48	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
49	N/A	N/A	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS

EXPERIMENTAL STUDIES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILITY
42	N/A	T4CDF	2.72 mg/kg feed	ND - 8.0 mg/kg fee
42	N/A	H7CDD	ND	N/A
42	N/A	OCDD	ND	N/A
42	N/A	H6CDD	ND	N/A
42	N/A	H6CDF	1.56 mg/kg feed	ND - 4.9 mg/kg fee
42	N/A	P5CDD	ND	N/A
42	N/A	OCDF	ND	N/A
42	N/A	H7CDF	0.89 mg/kg feed	ND - 3.4 mg/kg fee
42	N/A	P5CDF	2.85 mg/kg feed	ND - 7.1 mg/kg fee
42	N/A	TCDD	1.4 mg/kg feed	ND - 3.0 ppm
43	0.3-0.1 mg/inject.	OCDD	ND	N/A
43	0.3-0.1 mg/inject.	TCDD	60 ug/g feed	N/A
43	0.3-0.1 mg/inject.	OCDF	ND	N/A
43	0.3-0.1 mg/inject.	H6CDF	100 ug/g feed	N/A
43	0.3-0.1 mg/inject.	H7CDD	ND	N/A
43	0.3-0.1 mg/inject.	P5CDD	40 ug/g feed	N/A
43	0.3-0.1 mg/inject.	P5CDF	2200 ug/g feed	N/A
43	0.3-0.1 mg/inject.	TCDF	800 ug/g feed	N/A
43	0.3-0.1 mg/inject.	H6CDF	1100 ug/g feed	N/A
43	0.3-0.1 mg/inject.	H6CDD	ND	N/A
45	N/A	TCDF	0.35 %	N/A
45	N/A	TCDF	<0.02 %	N/A
45	N/A	TCDF	0.25%	N/A
45	N/A	TCDF	0.3%	N/A
45	N/A	TCDF	0.2%	N/A
45	N/A	TCDF	<0.01 %	N/A
45	N/A	TCDF	<0.01%	N/A
45	N/A	TCDF	1.6 %	N/A
45	N/A	TCDF	0.60 %	N/A
45	N/A	TCDF	0.5%	N/A
45	N/A	TCDF	0.75%	N/A
45	N/A	TCDF	<0.1%	N/A
45	N/A	TCDF	<0.02 %	N/A
45	N/A	TCDF	0.5%	N/A
45	N/A	TCDF	<0.1%	N/A
46	N/A	PCDF	0.1% - several %	N/A
48	N/A	PCDD/PCDF	ND	N/A
48	N/A	TCDD	21 ng/g wood	N/A
48	N/A	2,3,7,8 TCDD	0.6 ng/g wood	N/A
49	N/A	TCDF	Trace	N/A
49	N/A	TCDF	21 ug/g feed	N/A
49	N/A	PCDF	299 ug/g feed	N/A
49	N/A	PCDD	202 ug/g feed	N/A
49	N/A	TCDD	Trace	N/A
49	N/A	PCDD/PCDF	ND	N/A
49	N/A	PCDF	95 ug/g feed	N/A
49	N/A	PCDD	66 ug/g feed	N/A
49	N/A	PCDF	167 ug/g feed	N/A
49	N/A	TCDD	Trace	N/A
49	N/A	TCDF	Trace	N/A
49	N/A	PCDD	16 ug/g feed	N/A
49	N/A	TCDD	35 ug/g feed	N/A
52	N/A	PCDD/PCDF	47.4 mg/kg feed	N/A
52	N/A	PCDD/PCDF	415 mg/kg fedd	N/A
52	N/A	PCDD/PCDF	319 mg/kg feed	N/A

EXPERIMENTAL STUDIES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
42	2,4,5 T	Swed. W&A Pollution Res. Lab	G
42	2,4,5 T	Swed. W&A Pollution Res. Lab	I
42	2,4,5 T	Swed. W&A Pollution Res. Lab	I
42	2,4,5 T	Swed. W&A Pollution Res. Lab	I
42	2,4,5 T	Swed. W&A Pollution Res. Lab	G
42	2,4,5 T	Swed. W&A Pollution Res. Lab	I
42	2,4,5 T	Swed. W&A Pollution Res. Lab	I
42	2,4,5 T	Swed. W&A Pollution Res. Lab	G
42	2,4,5 T	Swed. W&A Pollution Res. Lab	G
42	2,4,5 T	Swed. W&A Pollution Res. Lab	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
43	Trichlorobenzene	Swiss Fed. Res. Station	G
45	2462'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	Aroclor 1254	Swiss Fed. Res.Station	G
45	Aroclor 1254	Swiss Fed. Res.Station	G
45	2452'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	2452'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	2462'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	2462'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	2452'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	Aroclor 1254	Swiss Fed. Res.Station	G
45	2462'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	Aroclor 1254	Swiss Fed. Res.Station	G
45	2452'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	Aroclor 1254	Swiss Fed. Res.Station	G
45	2462'4'5'Hexachlorob	Swiss Fed. Res.Station	G
45	2452'4'5'Hexachlorob	Swiss Fed. Res.Station	G
46	18 PCB Isomers	Swiss Fed. Res. Station	G
48	Pine and HCl	Wright State University	I
48	Pine and HCl	Wright State University	G
48	Pine and HCl	Wright State University	G
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables only	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
49	Vegetables plus Cl	Universita Roma	I
52	Diptork Sludge	Env. Canada/Deanborn Env. Ser.	G
52	2 4 5 TCP	Env. Canada/Deanborn Env. Ser.	G
52	2 4 5 TCP	Env. Canada/Deanborn Env. Ser.	G

REF #	SOURCE TYPE	FACILITY
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
52	EXPERIMENTAL	Chlorophenol Combustion
107	EXPERIMENTAL	quartz mini ampoules
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
113	EXPERIMENTAL	Fluidized Bed Oven
125	EXPERIMENTAL	N/A

EXPERIMENTAL STUDIES

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE	METHO
52	N/A	Lab Furn	Feed	GS
52	N/A	Lab Furn	Feed	GS
52	700 C, 0.5 sec	Lab Furn	FG	Meth Tr
52	N/A	Lab Furn	Feed	GS
52	900 C, 0.67 sec	Lab Furn	FG	Meth Tr
52	700 C, 0.7 sec	Lab Furn	FG	Meth Tr
52	900 C, 1.6 sec	Lab Furn	FG	Meth Tr
52	900 C, 3.4 sec	Lab Furn	FG	Meth Tr
52	N/A	Lab Furn	Feed	GS
52	700 C, 0.7 sec	Lab Furn	FG	Meth Tr
52	N/A	Lab Furn	Feed	GS
52	900 C, 3.4 sec	Lab Furn	FG	Meth Tra
52	250 C	Lab Furn	FG	Meth Tra
52	N/A	Lab Furn	Feed	GS
52	700 C, 15	Lab Furn	FG	Meth Tra
52	700 C, 0.5 sec	Lab Furn	FG	Meth Tra
52	250 C	Lab Furn	FG	Meth Tra
52	900 C, 1.6 sec	Lab Furn	FG	Meth Tra
52	N/A	Lab Furn	Feed	GS
107	500 - 600 C	N/A	FG	N/A
113	PCP Wood	N/A	FA	GS
113	PCP Wood	N/A	FA	GS
113	Painted Wood	N/A	FA	GS
113	Paper (Hypochlorite)	N/A	FA	GS
113	Painted Wood	N/A	FA	GS
113	PCP Wood	N/A	FA	GS
113	Paper (Hypochlorite)	N/A	FA	GS
113	Paper (Hypochlorite)	N/A	FA	GS
113	Painted Wood	N/A	FA	GS
113	PCP Wood	N/A	FA	GS
113	Painted Wood	N/A	FA	GS
113	Paper (Hypochlorite)	N/A	FA	GS
125	Treated Paper and Grass	N/A	FG	Gas Adsc

EXPERIMENTAL STUDIES

REF #	SAMPLE NUM.	EXTRACTION	ANALYSIS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
52	N/A	Trisodium Phosphate	GC/MS
107	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
113	N/A	N/A	GC/MS
125	6 Trials	Benzene/Methanol	GC/MS

EXPERIMENTAL STUDIES

REF #	DETECTION LIMITS	ISOMER	ISOMER CONC.	DATA VARIABILITY
52	N/A	TCDD/TCDF	6.8 mg/kg feed	N/A
52	N/A	TCDD/TCDF	16 mg/kg feed	N/A
52	N/A	PCDD/PCDF	249 mg/kg feed	N/A
52	N/A	PCDD/PCDF	186 mg/kg feed	N/A
52	N/A	TCDD/TCDF	1.4 mg/kg feed	N/A
52	N/A	TCDD/TCDF	39 mg/kg feed	N/A
52	N/A	TCDD/TCDF	0.6 mg/kg feed	N/A
52	N/A	TCDD/TCDF	2 mg/kg feed	N/A
52	N/A	PCDD/PCDF	0.13 mg/kg feed	N/A
52	N/A	PCDD/PCDF	771 mg/kg feed	N/A
52	N/A	TCDD/TCDF	70.4 mg/kg feed	N/A
52	N/A	PCDD/PCDF	309 mg/kg feed	N/A
52	N/A	TCDD/TCDF	50 mg/kg feed	N/A
52	N/A	TCDD/TCDF	26 mg/kg feed	N/A
52	N/A	TCDD/TCDF	95 mg/kg feed	N/A
52	N/A	TCDD/TCDF	4 mg/kg feed	N/A
52	N/A	PCDD/PCDF	630 mg/kg feed	N/A
52	N/A	PCDD/PCDF	134 mg/kg feed	N/A
52	N/A	PCDD/PCDF	292 mg/kg feed	N/A
107	N/A	PCDD/PCDF	N/A	0.1 - 4.5 %
113	N/A	PCDF	241 ppb	N/A
113	N/A	TCDF	97 ppb	N/A
113	N/A	TCDD	29 ppb	N/A
113	N/A	TCDD	1 ppb	N/A
113	N/A	TCDF	105 ppb	N/A
113	N/A	TCDD	47 ppb	N/A
113	N/A	PCDF	12 ppb	N/A
113	N/A	PCDD	24 ppb	N/A
113	N/A	PCDD	177 ppb	N/A
113	N/A	PCDD	324 ppb	N/A
113	N/A	PCDF	217 ppb	N/A
113	N/A	TCDF	4 ppb	N/A
125	N/A	2,3,7,8 TCDD	0.375 ug/g TCP	0.12 - 0.63 ug/g

EXPERIMENTAL STUDIES

REF #	PRECURSORS	SAMPLING ORGANIZATION	RATING
52	Diptork Sludge	Env. Canada/Deanborn Env. Ser.	G
52	Wood Brite 24	Env. Canada/Deanborn Env. Ser.	G
52	Alchem 4135	Env. Canada/Deanborn Env. Ser.	G
52	Wood Brite 24	Env. Canada/Deanborn Env. Ser.	G
52	Diptork Sludge	Env. Canada/Deanborn Env. Ser.	G
52	Wood Brite 24	Env. Canada/Deanborn Env. Ser.	G
52	Alchem 4135	Env. Canada/Deanborn Env. Ser.	G
52	Wood Brite 24	Env. Canada/Deanborn Env. Ser.	G
52	2 4 5 TCP	Env. Canada/Deanborn Env. Ser.	G
52	Wood Brite 24	Env. Canada/Deanborn Env. Ser.	G
52	Diptork Sludge	Env. Canada/Deanborn Env. Ser.	G
52	Wood Brite 24	Env. Canada/Deanborn Env. Ser.	G
52	Diptork Sludge	Env. Canada/Deanborn Env. Ser.	G
52	Alchem 4135	Env. Canada/Deanborn Env. Ser.	G
52	2 4 5 TCP	Env. Canada/Deanborn Env. Ser.	G
52	Alchem 4135	Env. Canada/Deanborn Env. Ser.	G
52	Diptork Sludge	Env. Canada/Deanborn Env. Ser.	G
52	Alchem 4135	Env. Canada/Deanborn Env. Ser.	G
52	Alchem 4135	Env. Canada/Deanborn Env. Ser.	G
107	PCDPEs	Univ of Umea	I
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
113	PCP/Hypochlorite	Wright State University	G
125	2.4.5 Trichloropheno	Dow Chemical	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #1
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
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4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #2
4	MSW INCINERATORS	Italy #3
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4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3
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4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FA
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Stack	FA

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
4	HRGC/MS	N/A	O8CDD
4	HRGC/MS	N/A	O8CDF
4	HRGC/MS	N/A	O8CDF
4	HRGC/MS	N/A	T4CDF
4	HRGC/MS	N/A	T4CDD
4	HRGC/MS	N/A	O8CDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	T4CDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	T4CDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	TCDF

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
4	63.9 ng/Nm3U	N/A	MSW
4	2.2 ng/Nm3U	N/A	MSW
4	59.3 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW
4	1.1 ng/Nm3U	N/A	MSW
4	8.0 ng/Nm3U	N/A	MSW
4	178.2 ng/Nm3U	N/A	MSW
4	1.03 ng/Nm3U	N/A	MSW
4	19.6 ng/Nm3U	N/A	MSW
4	11.5 ng/Nm3U	N/A	MSW
4	159.6 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW
4	27.9 ng/Nm3U	N/A	MSW
4	2.7 NG/nM3u	N/A	MSW
4	107.0 ng/Nm3U	N/A	MSW
4	575.0 ng/Nm3U	N/A	MSW
4	12015.0 ng/Nm3U	N/A	MSW
4	4390.0 ng/Nm3U	N/A	MSW
4	172.3 ng/Nm3U	N/A	MSW
4	1179.0 ng/Nm3U	N/A	MSW
4	172.2 ng/Nm3U	N/A	MSW
4	26620.0 ng/Nm3U	N/A	MSW
4	15.8 ppb	N/A	MSW
4	2883.0 ng/Nm3U	N/A	MSW
4	0.25 ppb	N/A	MSW
4	7312.0 ng/Nm3U	N/A	MSW
4	1.7 ppb	N/A	MSW
4	108.6 ng/Nm3U	N/A	MSW
4	294.0 ppb	N/A	MSW
4	17.0 ng/Nm3U	N/A	MSW
4	8.9 ppb	N/A	MSW
4	0.46 ppb	N/A	MSW
4	75.0 ng/Nm3U	N/A	MSW
4	828.0 ng/Nm3U	N/A	MSW
4	295.0 ppb	N/A	MSW
4	3.3 ppb	N/A	MSW
4	6542.0 ng/Nm3U	N/A	MSW
4	124.0 ng/Nm3U	N/A	MSW
4	0.037 ng/Nm3U	N/A	MSW
4	0.2 ng/Nm3U	N/A	MSW
4	0.8 ppb	N/A	MSW
4	6.7 ng/Nm3U	N/A	MSW
4	429.0 ng/Nm3U	N/A	MSW
4	0.3 ng/Nm3U	N/A	MSW
4	40.0 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW
4	0.08 ng/Nm3U	N/A	MSW
4	0.92 ppb	N/A	MSW
4	1.7 ng/Nm3U	N/A	MSW
4	1.8 ppb	N/A	MSW
4	776.0 ng/Nm3U	N/A	MSW
4	3.1 ppb	N/A	MSW
4	2.57 ng/Nm3U	N/A	MSW

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	I
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	I
4	Lab Prov di Igiene e Prof	G
4	Lab Prov di Igiene e Prof	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #3
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
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4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
4	MSW INCINERATORS	Italy #4
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4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Dust. Col.	FA
4	N/A	Stack	FA
4	N/A	Dust. Col.	FA
4	N/A	Dust. Col.	FA
4	N/A	Dust. Col.	FA
4	N/A	Stack	FA
4	N/A	Dust. Col.	FA
4	N/A	Stack	FG
4	N/A	Dust. Col.	FA
4	N/A	Stack	FA
4	N/A	Dust. Col.	FA
4	N/A	Stack	FG
4	N/A	Dust Col.	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FG
4	N/A	Stack	FA

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	TCDF

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
4	0.08 ng/Nm3U	N/A	MSW
4	1010.0 ng/Nm3U	N/A	MSW
4	1.5 ppb	N/A	MSW
4	61.7 ppb	N/A	MSW
4	10.9 ng/Nm3U	N/A	MSW
4	255.0 ppb	N/A	MSW
4	1760.0 ng/Nm3U	N/A	MSW
4	167.0 ng/Nm3U	N/A	MSW
4	3.2 ng/Nm3U	N/A	MSW
4	2703.0 ng/Nm3U	N/A	MSW
4	3.7 ng/Nm3U	N/A	MSW
4	1814.0 ng/Nm3U	N/A	MSW
4	60.0 ng/Nm3U	N/A	MSW
4	46.4 ppb	N/A	MSW
4	1390.0 ng/Nm3U	N/A	MSW
4	65.4 ppb	N/A	MSW
4	0.54 ng/Nm3U	N/A	MSW
4	2496.0 ppb	N/A	MSW
4	0.06 ng/Nm3U	N/A	MSW
4	87.9 ppb	N/A	MSW
4	2.8 ng/Nm3U	N/A	MSW
4	33.0 ng/Nm3U	N/A	MSW
4	39.0 ng/Nm3U	N/A	MSW
4	841.5 ppb	N/A	MSW
4	305.0 ng/Nm3U	N/A	MSW
4	3.2 ng/Nm3U	N/A	MSW
4	9.6 ng/Nm3U	N/A	MSW
4	89.0 Ng/Nm3U	N/A	MSW
4	21.0 ng/Nm3U	N/A	MSW
4	0.34 ng/Nm3U	N/A	MSW
4	328.0 ng/Nm3U	N/A	MSW
4	196.0 ng/Nm3U	N/A	MSW
4	46.0 ng/Nm3U	N/A	MSW
4	173.0 ng/Nm3U	N/A	MSW
4	0.7 ppb	N/A	MSW
4	75.3 ng/Nm3U	N/A	MSW
4	0.05 ppb	N/A	MSW
4	0.0015 ppb	N/A	MSW
4	0.021 ppb	N/A	MSW
4	9.9 ng/Nm3U	N/A	MSW
4	0.007 ppb	N/A	MSW
4	244.0 ng/Nm3U	N/A	MSW
4	1.18 ppb	N/A	MSW
4	2.4 ng/Nm3U	N/A	MSW
4	0.1 ppb	N/A	MSW
4	27.0 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW
4	ND	N/A	MSW
4	24.0 ng/Nm3U	N/A	MSW
4	71.0 ng/Nm3U	N/A	MSW
4	19.0 ng/Nm3U	N/A	MSW
4	6.0 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
4	MSW INCINERATORS	Italy #6
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
5	MSW INCINERATORS	Como, Italy
6	MSW INCINERATORS	Beveren, Belgium
6	MSW INCINERATORS	Beveren, Belgium
6	MSW INCINERATORS	Beveren, Belgium
6	MSW INCINERATORS	Beveren, Belgium
7	MSW INCINERATORS	Alkamaar, Netherlands
7	MSW INCINERATORS	Alkamaar, Netherlands
7	MSW INCINERATORS	Alkamaar, Netherlands
7	MSW INCINERATORS	Alkamaar, Netherlands
7	MSW INCINERATORS	Alkamaar, Netherlands
7	MSW INCINERATORS	Alkamaar, Netherlands
7	MSW INCINERATORS	Amsterdam, Netherlands
7	MSW INCINERATORS	Amsterdam, Netherlands
7	MSW INCINERATORS	Amsterdam, Netherlands
7	MSW INCINERATORS	Amsterdam, Netherlands
7	MSW INCINERATORS	Amsterdam, Netherlands
7	MSW INCINERATORS	Amsterdam, Netherlands
7	MSW INCINERATORS	Arnhem, Netherlands
7	MSW INCINERATORS	Arnhem, Netherlands
7	MSW INCINERATORS	Arnhem, Netherlands
7	MSW INCINERATORS	Arnhem, Netherlands
7	MSW INCINERATORS	Arnhem, Netherlands
7	MSW INCINERATORS	Arnhem, Netherlands
7	MSW INCINERATORS	Leewarden, Netherlands
7	MSW INCINERATORS	Leewarden, Netherlands
7	MSW INCINERATORS	Leewarden, Netherlands
7	MSW INCINERATORS	Leewarden, Netherlands
7	MSW INCINERATORS	Leewarden, Netherlands
7	MSW INCINERATORS	Leewarden, Netherlands
7	MSW INCINERATORS	Leiden, Netherlands
7	MSW INCINERATORS	Leiden, Netherlands

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Stack	FG
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Dust Col.	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
4	N/A	Stack	FA
4	N/A	Stack	FA
4	N/A	Stack	FA
4	N/A	Dust Col.	FA
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
5	> 500 degrees C	Stack	FG
6	Domestic/Industrial Wastes	stack	FG/FA
6	Domestic/Industrial Wastes	stack	FG/FA
6	Domestic/Industrial Wastes	stack	FG/FA
6	Domestic/Industrial Wastes	stack	FG/FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	Train	N/A	Hexane
4	GS	N/A	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
5	MM5T	17 Samples/9 Months	Hexane
6	Train	12 test	N/A
6	Train	12 test	N/A
6	Train	12 test	N/A
6	Train	12 test	N/A
7	GS	17 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	17 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	17 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	17 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	17 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	17 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	14 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	14 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	14 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	14 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	14 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	14 Samples/1.5 years	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)
7	GS	5 months	Soxhlet/Tolulene(24 hr)

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	P5CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	TCDF
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	OCDD
4	HRGC/MS	N/A	H7CDD
4	HRGC/MS	N/A	TCDD
4	HRGC/MS	N/A	H6CDD
4	HRGC/MS	N/A	OCDF
4	HRGC/MS	N/A	OCDD
5	GC/MS	N/A	OCDF
5	GC/MS	N/A	OCDD
5	GC/MS	N/A	H7CDF
5	GC/MS	N/A	TCDF
5	GC/MS	N/A	P5CDD
5	GC/MS	N/A	P5CDF
5	GC/MS	N/A	H7CDD
5	GC/MS	N/A	H6CDD
5	GC/MS	N/A	TCDD
5	GC/MS	N/A	H6CDF
6	GC/MS	N/A	TCDF
6	GC/MS	N/A	PCDF
6	GC/MS	N/A	TCDD
6	GC/MS	N/A	PCDD
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	OCDF

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
4	480.0 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW
4	11.0 ng/Nm3U	N/A	MSW
4	0.010 ng/Nm3U	N/A	MSW
4	1.93 ppb	N/A	MSW
4	ND	N/A	MSW
4	ND	N/A	MSW
4	0.51 ng/Nm3U	N/A	MSW
4	0.0012 ppb	N/A	MSW
4	ND	N/A	MSW
4	0.28 ng/Nm3U	N/A	MSW
4	ND	N/A	MSW
4	5.86 ppb	N/A	MSW
5	123.8 ng/Ncm	17 - 749 ng/Ncm	MSW
5	125.9 ng/Ncm	19 - 631 ng/Ncm	MSW
5	215.1 ng/Ncm	25 - 1414 ng/Ncm	MSW
5	309 ng/Ncm	17 - 2846 ng/Ncm	MSW
5	ND	13 - 2080 ng/Ncm	MSW
5	250.3 ng/Ncm	17 - 2261 ng/Ncm	MSW
5	286.3 ng/Ncm	13 - 2884 ng/Ncm	MSW
5	366 ng/Ncm	15 - 3806 ng/Ncm	MSW
5	128.4 ng/Ncm	7 - 1127 ng/Ncm	MSW
5	314.2 ng/Ncm	22 - 2928 ng/Ncm	MSW
6	N/A	2 - 30 ng/m3	PCBs, PCPs
6	N/A	37 - 306 ng/m3	PCBs, PCPs
6	N/A	0.1 - 7 ng/m3	PCBs, PCPs
6	N/A	82.1 - 433 ng/m3	PCBs, PCPs
7	421.2 ppb	160 - 1260 ppb	MSW
7	435.2 ppb	190 - 892 ppb	MSW
7	220.1 ppb	76 - 410 ppb	MSW
7	18 ppb	0 - 126 ppb	MSW
7	96.4 ppb	22 - 236 ppb	MSW
7	113.8 ppb	50 - 206	MSW
7	152.2 ppb	40 - 283 ppb	MSW
7	401.0 ppb	23 - 1565 ppb	MSW
7	61.5 ppb	12 - 184 ppb	MSW
7	28.0 ppb	ND - 97 ppb	MSW
7	128.3 ppb	29 - 287 ppb	MSW
7	14.1 ppb	2-29 ppb	MSW
7	91 ppb	N/A	MSW
7	51 ppb	N/A	MSW
7	24 ppb	N/A	MSW
7	82 ppb	N/A	MSW
7	11 ppb	N/A	MSW
7	136 ppb	N/A	MSW
7	10 ppb	N/A	MSW
7	110 ppb	N/A	MSW
7	226 ppb	N/A	MSW
7	240 ppb	N/A	MSW
7	280 ppb	N/A	MSW
7	560 ppb	N/A	MSW
7	550 ppb	N/A	MSW
7	110 ppb	N/A	MSW

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	G
4	Lab.Prov. di Igiene e Prof.	I
4	Lab.Prov. di Igiene e Prof.	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	I
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
5	Inst. Pharm. Res.,Milan,Italy	G
6	Univ of Antwerp	G
6	Univ of Antwerp	G
6	Univ of Antwerp	G
6	Univ of Antwerp	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
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7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
7	MSW INCINERATORS	Leiden, Netherlands
7	MSW INCINERATORS	Leiden, Netherlands
7	MSW INCINERATORS	Leiden, Netherlands
7	MSW INCINERATORS	Leiden, Netherlands
7	MSW INCINERATORS	Rijnmond, Netherlands
7	MSW INCINERATORS	Rijnmond, Netherlands
7	MSW INCINERATORS	Rijnmond, Netherlands
7	MSW INCINERATORS	Rijnmond, Netherlands
7	MSW INCINERATORS	Rijnmond, Netherlands
7	MSW INCINERATORS	Rijnmond, Netherlands
7	MSW INCINERATORS	Roosendaal, Netherlands
7	MSW INCINERATORS	Roosendaal, Netherlands
7	MSW INCINERATORS	Roosendaal, Netherlands
7	MSW INCINERATORS	Roosendaal, Netherlands
7	MSW INCINERATORS	Roosendaal, Netherlands
7	MSW INCINERATORS	Roosendaal, Netherlands
7	MSW INCINERATORS	Rotterdam, Netherlands
7	MSW INCINERATORS	Rotterdam, Netherlands
7	MSW INCINERATORS	Rotterdam, Netherlands
7	MSW INCINERATORS	Rotterdam, Netherlands
7	MSW INCINERATORS	Rotterdam, Netherlands
7	MSW INCINERATORS	Rotterdam, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
7	MSW INCINERATORS	Zaanstad, Netherlands
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
7	N/A	Stack	FG
7	N/A	ESP	FA
9	Industrial Spreader Stoker	Stack	FG
9	Incinerator/Boiler	Stack	FG
9	Incinerator/Boiler	Stack	FG
9	Industrial Spreader Stoker	Stack	FG
9	Incinerator/Boiler	-----	Feed

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	5 months	Soxhlet/Toluene(24 hr)
7	GS	23 Samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	GS	23 Samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	GS	23 Samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	GS	23 Samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	GS	23 Samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	GS	23 Samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
7	Train	14 samples/1.5 years	Soxhlet/Toluene(24 hr)
7	Cont. S	10/2 hrs	Soxhlet/Toluene(24 hr)
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	GS	2-4 Days	Hexane/KOH

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	P5CDD
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	P5CDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	TCDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	H7CDD
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	P5CDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	H7CDF
7	GC/MS	N/A	H7CDF
7	GC/MS	N/A	H6CDF
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	H7CDD
7	GC/MS	N/A	TCDD
7	GC/MS	N/A	OCDD
7	GC/MS	N/A	P5CDF
7	GC/MS	N/A	OCDF
7	GC/MS	N/A	H6CDD
7	GC/MS	N/A	TCDF
9	GC/HRMS	120 pg/me	2,3,7,8 TCDF
9	GC/HRMS	120 pg/m3	2,3,7,8 TCDF
9	GC/HRMS	120 pg/m3	TCDF
9	GC/HRMS	25 pg/m3	TCDD
9	GC/HRMS	25 pg/m3	TCDD

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
7	220 ppb	N/A	MSW
7	530 ppb	N/A	MSW
7	212 ppb	N/A	MSW
7	910 ppb	N/A	MSW
7	ND	N/A	MSW
7	10 ppb	N/A	MSW
7	50 ppb	N/A	MSW
7	60 ppb	N/A	MSW
7	10 ppb	N/A	MSW
7	10 ppb	N/A	MSW
7	40 ppb	N/A	MSW
7	150 ppb	N/A	MSW
7	190 ppb	N/A	MSW
7	330 ppb	N/A	MSW
7	40 ppb	N/A	MSW
7	110 ppb	N/A	MSW
7	70 ppb	N/A	MSW
7	70 ppb	N/A	MSW
7	190 ppb	N/A	MSW
7	18 ppb	N/A	MSW
7	140 ppb	N/A	MSW
7	20 ppb	N/A	MSW
7	106.5 ppb	19 - 295 ppb	MSW
7	433.8 ppb	242 - 633 ppb	MSW
7	1576.3 ppb	1070 - 2030 ppb	MSW
7	730.9 ppb	49 - 1600 ppb	MSW
7	399.1 ppb	222 - 568 ppb	MSW
7	358.7 ppb	37 - 1017 ppb	MSW
7	528.4 ng/Nm3	174 - 1437 ng/Nm3	MSW
7	211.0 ppb	20 - 471 ppb	MSW
7	161.1 ng/Nm3	46 - 556 ng/Nm3	MSW
7	590.0 ppb	82 - 1330 ppb	MSW
7	177.0 ng/Nm3	124 - 922 ng/Nm3	MSW
7	60.13 ppb	4 - 223 ppb	MSW
7	132.1 ng/Nm3	22 - 714 ng/Nm3	MSW
7	88.8 ppb	61 - 135 ppb	MSW
7	67.6 ng/Nm3	ND - 201 ng/Nm3	MSW
7	541.5 ppb	397 - 699 ppb	MSW
7	204.2 ng/Nm3	155 - 504 ng/Nm3	MSW
7	863.1	566 - 1310 ppb	MSW
7	451.7 ng/Nm3	25 - 3711 ng/Nm3	MSW
7	1701.5 ppb	1160 - 2140 ppb	MSW
7	57.1 ng/Nm3	10 - 218 ng/Nm3	MSW
7	1372.6 ppb	598 - 1550 ppb	MSW
7	155.2 ng/Nm3	109 - 702 ng/Nm3	MSW
7	94.2 ppb	37 - 145 ppb	MSW
7	439.8 ng/Nm3	111 - 1953 ng/Nm3	MSW
7	182.7 ppb	108 - 291 ppb	MSW
9	99.5 ng/m3	85 - 114 ng/m3	RDF
9	10.3 ng/m3	1.9 - 24 ng/m3	MSW/Waste Oil
9	21 ng/m3	4.5 - 47.7 ng/m3	MSW/Waste Oil
9	29.7 ng.m3	29.5 - 30 ng/m3	RDF
9	ND	N/A	MSW/Waste Oil

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	I
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
7	Univ. of Amsterdam	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
9	MSW INCINERATORS	U.S.A. Facilities
10	MSW INCINERATORS	Hempstead
11	MSW INCINERATORS	U.S.
11	MSW INCINERATORS	U.S.
12	MSW INCINERATORS	France (1)
12	MSW INCINERATORS	France (1)
12	MSW INCINERATORS	France (1)
12	MSW INCINERATORS	France (1)
12	MSW INCINERATORS	France (1)
30	MSW INCINERATORS	U.S.
30	MSW INCINERATORS	U.S.
30	MSW INCINERATORS	U.S.
30	MSW INCINERATORS	U.S.
30	MSW INCINERATORS	U.S.
56	MSW INCINERATORS	N/A
56	MSW INCINERATORS	N/A
56	MSW INCINERATORS	N/A
69	MSW INCINERATORS	W. Germany MIP (LFI-NW)
69	MSW INCINERATORS	W. Germany MIP (MA-LfU)
69	MSW INCINERATORS	W. Germany MIP (S-LfU)
69	MSW INCINERATORS	W. Germany MIP (SM 283)
69	MSW INCINERATORS	W. Germany MIP (SM 294)
69	MSW INCINERATORS	W. Germany, MIP (SM 03,81)
69	MSW INCINERATORS	W. Germany, Power Plant (coal)
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
74	MSW INCINERATORS	European
76	MSW INCINERATORS	Zurich, Switzerland
76	MSW INCINERATORS	Zurich, Switzerland
83	MSW INCINERATORS	Ontario, Canada (1)
83	MSW INCINERATORS	Ontario, Canada (1)
83	MSW INCINERATORS	Ontario, Canada (1)
83	MSW INCINERATORS	Ontario, Canada (1)

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
9	Small Modular	Stack	FG
9	Small Modular	Stack	FG
9	Incinerator/Boiler	Stack	FG
9	Incinerator/Boiler	-----	Feed
9	Industrial Spreader Stoker	Stack	FG
9	Industrial Spreader Stoker	Stack	FG
9	Small Modular	Stack	FG
9	Small Modular	Stack	FG
9	Incinerator/Boiler	Stack	FG
10	RDF/Energy Recovery	Stack	FA
11	N/A	Stack	FG/FA
11	N/A	Stack	FG/FA
12	950 degrees C	ESP	FA
12	950 degrees C	ESP	FA
12	950 degrees C	ESP	FA
12	950 degrees C	ESP	FA
12	950 degrees C	ESP	FA
30	N/A	Stack	FG
30	N/A	Stack	FG
30	N/A	Stack	FG
30	N/A	Stack	FG
30	N/A	Stack	FG
56	One Plant	Grate	ASH
56	One Plant	Stack	FG
56	One Plant	ESP	FA
69	N/A	N/A	FA
69	N/A	N/A	FA
69	N/A	N/A	FA
69	N/A	N/A	FA
69	N/A	N/A	FA
69	N/A	N/A	FA
69	N/A	N/A	FA
74	Inc. after compost production	N/A	FA
74	Inc. after compost production	N/A	FA
74	Inc. without any treatment	N/A	FA
74	Inc. after recycling	N/A	FA
74	Inc. after recycling	N/A	FA
74	Inc. after compost production	N/A	FA
74	Inc. without any treatment	N/A	FA
74	Inc. after compost production	N/A	FA
74	Inc. after recycling	N/A	FA
74	Inc. after recycling	N/A	FA
74	Inc. without any treatment	N/A	FA
74	Inc. without any treatment	N/A	FA
74	Inc. without any treatment	N/A	FA
74	Inc. after compost production	N/A	FA
74	Inc. after recycling	N/A	FA
76	N/A	Stack/ESP	FA
76	N/A	Stack/ESP	FA
83	N/A	ESP	FA
83	N/A	ESP	FA
83	N/A	ESP	FA
83	N/A	ESP	FA

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	GS	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
9	MM5T	2-4 Days	Hexane/KOH
10	SSAS	11	Methylene Chloride
11	MM5T	N/A	N/A
11	MM5T	N/A	N/A
12	GS	1 Sample	Ultrasomic/Benzene
12	GS	1 Sample	Ultrasomic/Benzene
12	GS	1 Sample	Ultrasomic/Benzene
12	GS	1 Sample	Ultrasomic/Benzene
12	GS	1 Sample	Ultrasomic/Benzene
30	MM5T	5 Samples	N/A
30	MM5T	5 Samples	N/A
30	MM5T	5 Samples	N/A
30	MM5T	5 Samples	N/A
30	MM5T	5 Samples	N/A
56	GS	3 - 8 Samples	Soxhlet/Methylene Chloride
56	SSAS	3 - 8 Samples	Soxhlet/Methylene Chloride
56	GS	3 - 8 Samples	Soxhlet/Methylene Chloride
69	GS	N/A	Tolulene/Methanol
69	GS	N/A	Tolulene/Methanol
69	GS	N/A	Tolulene/Methanol
69	GS	N/A	Tolulene/Methanol
69	GS	N/A	Tolulene/Methanol
69	GS	N/A	Tolulene/Methanol
69	GS	N/A	Tolulene/Methanol
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
74	GS	N/A	Soxhlet/Tolulene
76	N/A	N/A	Methylene Chloride
76	N/A	N/A	Methylene Chloride
83	WEEKLY GS	8 weeks / 3 rep.	Soxhlet/Benzene(16 hr)
83	WEEKLY GS	8 weeks / 3 rep.	Soxhlet/Benzene(16 hr)
83	WEEKLY GS	8 weeks / 3 rep.	Soxhlet/Benzene(16 hr)
83	WEEKLY GS	8 weeks / 3 rep.	Soxhlet/Benzene(16 hr)

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
9	GC/HRMS	120 pg/m3	2,3,7,8 TCDF
9	GC/HRMS	25 pg/m3	2,3,7,8 TCDD
9	GC/HRMS	25 pg/m3	2,3,7,8 TCDD
9	GC/HRMS	120 pg/m3	TCDF
9	GC/HRMS	120 pg/me	TCDF
9	GC/HRMS	25 pg/m3	2,3,7,8 TCDD
9	GC/HRMS	120 pg/m3	TCDF
9	GC/HRMS	25 pg/m3	TCDD
9	GC/HRMS	25 pg/m3	TCDD
10	GC/HRMS	N/A	TCDD
11	GC/MS	N/A	PCDD
11	GC/MS	N/A	TCDD
12	GC/MS	100pg - 200 pg/g	OCDD
12	GC/MS	100pg - 200 pg/g	H7CDD
12	GC/MS	100pg - 200 pg/g	P5CDD
12	GC/MS	100pg - 200 pg/g	H6CDD
12	GC/MS	100pg - 200 pg/g	TCDD
30	GC/MS	0.04 ng	H6CDD
30	GC/MS	0.04 ng	H7CDD
30	GC/MS	0.04 ng	TCDD
30	GC/MS	0.04 ng	OCDD
30	GC/MS	0.04 ng	2,3,7,8 TCDD
56	GC/MS	0.1ng/g	2,3,7,8 TCDD
56	GC/MS	0.0005 ng/l	2,3,7,8 TCDD
56	GC/MS	0.1 ng/g	2,3,7,8 TCDD
69	GC/MS	0.1 ppb	OCDD
69	GC/MS	0.1 ppb	OCDD
69	GC/MS	0.1 ppb	OCDD
69	GC/MS	0.1 ppb	OCDD
69	GC/MS	0.1 ppb	OCDD
69	GC/MS	0.1 ppb	OCDD
69	GC/MS	0.1 ppb	OCDD
74	GC/MS	N/A	H6CDF
74	GC/MS	N/A	OCDD
74	GC/MS	N/A	H6CDD
74	GC/MS	N/A	H6CDD
74	GC/MS	N/A	H7CDF
74	GC/MS	N/A	OCDF
74	GC/MS	N/A	H6CDF
74	GC/MS	N/A	H7CDF
74	GC/MS	N/A	H6CDF
74	GC/MS	N/A	OCDF
74	GC/MS	N/A	OCDF
74	GC/MS	N/A	H7CDF
74	GC/MS	N/A	OCDD
74	GC/MS	N/A	H6CDD
74	GC/MS	N/A	OCDD
76	GC/MS	N/A	PCDD
76	GC/MS	N/A	PCDF
83	GC/MS	N/A	H6CDD
83	GC/MS	N/A	H7CDD
83	GC/MS	N/A	P5CDD
83	GC/MS	N/A	TCDD

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
9	5.4 ng/m3	2.8 - 7.9 ng/m3	Processed MSW
9	0.295 ng/m3	.29 - .30 ng/m3	Processed MSW
9	1.05 ng/m3	1.1 - 1.2 ng/m3	MSW/Waste Oil
9	ND	N/A	MSW/Waste Oil
9	279.5 ng/m3	247 - 312 ng/m3	RDF
9	9.1 ng/m3	8.6 - 9.6 ng/m3	RDF
9	11.1 ng/m3	8.3 - 14 ng/m3	Processed MSW
9	1.2 ng/m3	1.1 - 1.3 ng/m3	Processed MSW
9	3.15 ng/m3	2.5 - 3.8 ng/m3	MSW/Waste Oil
10	19.1 ng/sample	1.2-35 ng/sample	RDF/Biocide
11	2300 ng/m3	N/A	MSW
11	0.24 ug/m3	N/A	MSW
12	185.8 ng/g	N/A	MSW
12	62.4 ng/g	N/A	MSW
12	7.8 ng/g	N/A	MSW
12	21.8 ng/g	N/A	MSW
12	275 ng/g	N/A	MSW
30	42.2 ng	ND - 76 ng	MSW
30	10 ng	ND - 25 ng	MSW
30	31.46 ng	8 - 42.2 ng	MSW
30	ND	N/A	MSW
30	1.9 ng	0.5 - 2.8 ng	MSW
56	ND	N/A	MSW/Coal
56	ND	N/A	MSW/Coal
56	ND	N/A	MSW/Coal
69	800 ug/kg	N/A	MSW
69	15 ug/kg	N/A	MSW
69	520 ug/kg	N/A	MSW
69	1 ug/kg	N/A	MSW
69	13 ug/kg	N/A	MSW
69	<0.5 ug/kg	N/A	MSW
69	<0.5 ug/kg	N/A	MSW
74	ND	N/A	MSW
74	5 ppb	N/A	MSW
74	90.6 ppb	42 - 145 ppb	MSW
74	6 ppb	N/A	MSW
74	ND	N/A	MSW
74	ND	N/A	MSW
74	88 ppb	39 - 135 ppb	MSW
74	ND	N/A	MSW
74	ND	N/A	MSW
74	ND	N/A	MSW
74	43.6 ppb	31 - 65 ppb	MSW
74	49.3 ppb	30 - 68 ppb	MSW
74	120 ppb	90 - 152 ppb	MSW
74	5 ppb	N/A	MSW
74	12 ppb	N/A	MSW
76	0.2 ppm	N/A	Mun.&Ind. S.W.
76	0.1 ppm	N/A	Mun.&Ind. S.W.
83	25.8 ppb	2.2 - 58 ppb	MSW
83	14.9 ppb	1.1 - 43 ppb	MSW
83	23.2 ppb	3.4 - 45 ppb	MSW
83	13.5 ppb	3.2 - 27 ppb	MSW

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
9	Systech Corp.	G
10	Wright State Univ.	G
11	MRI	G
11	MRI	G
12	Univ. of Waterloo, Ontario	G
12	Univ. of Waterloo, Ontario	G
12	Univ. of Waterloo, Ontario	G
12	Univ. of Waterloo, Ontario	G
12	Univ. of Waterloo, Ontario	G
30	U.S. EPA	G
30	U.S. EPA	G
30	U.S. EPA	G
30	U.S. EPA	G
30	U.S. EPA	G
56	Ames Lab, Iowa St. Univ.	G
56	Ames Lab, Iowa St. Univ.	G
56	Ames Lab, Iowa St. Univ.	G
69	Univ. of Ulm, Germany	G
69	Univ. of Ulm, Germany	G
69	Univ. of Ulm, Germany	G
69	Univ. of Ulm, Germany	G
69	Univ. of Ulm, Germany	G
69	Univ. of Ulm, Germany	G
69	Univ. of Ulm, Germany	G
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
74	Inst. Inguin. Atmos., CNR	I
76	Swiss Fed. Res. Station	I
76	Swiss Fed. Res. Station	I
83	Ont. Min. of the Env.	G
83	Ont. Min. of the Env.	G
83	Ont. Min. of the Env.	G
83	Ont. Min. of the Env.	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
83	MSW INCINERATORS	Ontario, Canada (1)
84	MSW INCINERATORS	Ontario, Canada (2)
84	MSW INCINERATORS	Ontario, Canada (2)
84	MSW INCINERATORS	Ontario, Canada (2)
84	MSW INCINERATORS	Ontario, Canada (2)
84	MSW INCINERATORS	Ontario, Canada (2)
85	MSW INCINERATORS	Japan (#1)
85	MSW INCINERATORS	Japan (#2)
85	MSW INCINERATORS	Netherlands
85	MSW INCINERATORS	Ontario (#1)
85	MSW INCINERATORS	Ontario (#2)
89	MSW INCINERATORS	Municipal Incinerator (USA)
89	MSW INCINERATORS	Municipal Incinerator (USA)
89	MSW INCINERATORS	Municipal Incinerator (USA)
89	MSW INCINERATORS	Municipal Incinerator (USA)
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
104	MSW INCINERATORS	Urban Incinerator, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Bologna, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Florence, Italy
105	MSW INCINERATORS	Milano, Italy
105	MSW INCINERATORS	Milano, Italy
105	MSW INCINERATORS	Milano, Italy
105	MSW INCINERATORS	Milano, Italy

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
83	N/A	ESP	FA
84	N/A	ESP	FA
84	N/A	ESP	FA
84	N/A	ESP	FA
84	N/A	ESP	FA
84	N/A	ESP	FA
85	N/A	ESP	FA
85	N/A	ESP	FA
85	N/A	ESP	FA
85	N/A	ESP	FA
85	N/A	ESP	FA
89	N/A	Stack	FA
89	N/A	Stack	FA
89	N/A	Furnace	Ash
89	N/A	Furnace	Ash
104	N/A	ESP	FA
104	N/A	ESP	FA
104	N/A	ESP	FA
104	N/A	Furnace	Ash
104	N/A	Furnace	Ash
104	N/A	Stack	FA
104	N/A	ESP	FA
104	N/A	Stack	FA
104	N/A	ESP	FA
104	N/A	Stack	FA
104	N/A	Furnace	Ash
104	N/A	Stack	FA
104	N/A	Furnace	Ash
104	N/A	Stack	FA
104	N/A	Furnace	Ash
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	Furnace	Ash
105	Urban Incinerators	Furnace	Ash
105	Urban Incinerators	Furnace	Ash
105	Urban Incinerators	Furnace	Ash
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	Furnace	Ash
105	Urban Incinerators	Stack	FA
105	Urban Incinerators	Stack	FA
105	Urban Incinerators	Stack	FA
105	Urban Incinerators	Stack	FA
105	Urban Incinerators	Stack	FA
105	Urban Incinerators	Stack	FG
105	Urban Incinerators	Stack	FG
105	Urban Incinerators	Stack	FG
105	Urban Incinerators	Stack	FG
105	Urban Incinerators	Stack	FG
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	ESP	FA

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
83	WEEKLY GS	8 weeks / 3 rep.	Soxhlet/Benzene(16 hr)
84	GS	5 replications	Ultrasonic/Benzene(1 hr)
84	GS	5 replications	Ultrasonic/Benzene(1 hr)
84	GS	5 replications	Ultrasonic/Benzene(1 hr)
84	GS	5 replications	Ultrasonic/Benzene(1 hr)
84	GS	5 replications	Ultrasonic/Benzene(1 hr)
85	GS	1 Sample	Soxhlet/Benzene
85	GS	1 Sample	Soxhlet/Benzene
85	GS	1 Sample	Soxhlet/Benzene
85	GS	1 Sample	Soxhlet/Benzene
85	GS	1 Sample	Soxhlet/Benzene
89	GS	1 Sample	N/A
89	GS	1 Sample	N/A
89	GS	1 Sample	N/A
89	GS	1 Sample	N/A
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
104	GS	1 Sample	Soxhlet/Benzene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	MM5T	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
83	GC/MS	N/A	OCDD
84	GC/MS	N/A	H6CDD
84	GC/MS	N/A	P5CDD
84	GC/MS	N/A	H7CDD
84	GC/MS	N/A	OCDD
84	GC/MS	N/A	TCDD
85	GC/MS	N/A	TCDD
85	GC/MS	N/A	TCDD
85	GC/MS	N/A	TCDD
85	GC/MS	N/A	TCDD
85	GC/MS	N/A	TCDD
85	GC/MS	N/A	TCDD
89	GC/HRMS	65 ppt	TCDF
89	GC/HRMS	60 ppt	TCDD
89	GC/HRMS	10 ppt	TCDF
89	GC/HRMS	5 ppt	TCDD
104	GC/MS	N/A	H7CDD
104	GC/MS	N/A	TCDD
104	GC/MS	N/A	OCDD
104	GC/MS	N/A	H7CDD
104	GC/MS	N/A	P5CDD
104	GC/MS	N/A	OCDD
104	GC/MS	N/A	H6CDD
104	GC/MS	N/A	H6CDD
104	GC/MS	N/A	P5CDD
104	GC/MS	N/A	TCDD
104	GC/MS	N/A	H6CDD
104	GC/MS	N/A	H7CDD
104	GC/MS	N/A	TCDD
104	GC/MS	N/A	P5CDD
104	GC/MS	N/A	OCDD
105	GC/MS	N/A	H6CDD/H6CDF
105	GC/MS	N/A	TCDD/TCDF
105	GC/MS	N/A	P5CDD/P5CDF
105	GC/MS	N/A	OCDD/OCDF
105	GC/MS	N/A	H6CDD/H6CDF
105	GC/MS	N/A	H7CDD/H7CDF
105	GC/MS	N/A	TCDD/TCDF
105	GC/MS	N/A	P5CDD/P5CDF
105	GC/MS	N/A	H7CDD/H7CDF
105	GC/MS	N/A	H6CDD/H6CDF
105	GC/MS	N/A	P5CDD/P5CDF
105	GC/MS	N/A	H7CDD/H7CDF
105	GC/MS	N/A	TCDD/TCDF
105	GC/MS	N/A	OCDD/OCDF
105	GC/MS	N/A	OCDD/OCDF
105	GC/MS	N/A	H6CDD/H6CDF
105	GC/MS	N/A	H7CDD/H7CDF
105	GC/MS	N/A	P5CDD/P5CDF
105	GC/MS	N/A	TCDD/TCDF
105	GC/MS	N/A	TCDD/TCDF
105	GC/MS	N/A	H7CDD/H7CDF
105	GC/MS	N/A	OCDD/OCDF
105	GC/MS	N/A	P5CDD/P5CDF

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
83	6.3 ppb	0.4 - 26 ppb	MSW
84	13.0 ppb	11.0 - 17.0 ppb	MSW
84	15.0 ppb	12.0 - 20.0 ppb	MSW
84	3.2 ppb	2.3 - 4.3 ppb	MSW
84	0.4 ppb	0.28 - 0.53 ppb	MSW
84	8.6 ppb	6.7 - 11.0 ppb	MSW
85	4.8 ng/g	N/A	MSW
85	8.5 ng/g	N/A	MSW
85	2.4 ng/g	N/A	MSW
85	10 ng/g	N/A	MSW
85	9.3 ng/g	N/A	MSW
89	45,000 ppt	N/A	MSW
89	10,000 ppt	N/A	MSW
89	2000 ppt	N/A	MSW
89	45 ppt	N/A	MSW
104	55 ng/g	N/A	MSW/PCB
104	Trac.	N/A	MSW/PCB
104	50 ng/g	N/A	MSW/PCB
104	16 ng/g	N/A	MSW/PCB
104	4 ng/g	N/A	MSW/PCB
104	900 ng/g	N/A	MSW/PCB
104	53 ng/g	N/A	MSW/PCB
104	540 ng/g	N/A	MSW/PCB
104	6 ng/g	N/A	MSW/PCB
104	40 ng/g	N/A	MSW/PCB
104	16 ng/g	N/A	MSW/PCB
104	900 ng/g	N/A	MSW/PCB
104	Trac.	N/A	MSW/PCB
104	110 ng/g	N/A	MSW/PCB
104	35 ng/g	N/A	MSW/PCB
105	235 ppb	N/A	Untreated MSW
105	16 ppb	N/A	Untreated MSW
105	20 ppb	N/A	Untreated MSW
105	390 ppb	N/A	Untreated MSW
105	33 ppb	N/A	Untreated MSW
105	345 ppb	N/A	Untreated MSW
105	112 ppb	N/A	Untreated MSW
105	205 ppb	N/A	Untreated MSW
105	113 ppb	N/A	Untreated MSW
105	185 ppb	N/A	Untreated MSW
105	240 ppb	N/A	Untreated MSW
105	400 ppb	N/A	Untreated MSW
105	175 ppb	N/A	Untreated MSW
105	570 ppb	N/A	Untreated MSW
105	31 ppb	N/A	Untreated MSW
105	125 ppb	N/A	Untreated MSW
105	105 ppb	N/A	Untreated MSW
105	ND	N/A	Untreated MSW
105	ND	N/A	Untreated MSW
105	51 ppb	N/A	Untreated MSW
105	310 ppb	N/A	Untreated MSW
105	547 ppb	N/A	Untreated MSW
105	115 ppb	N/A	Untreated MSW

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
83	Ont. Min. of the Env.	G
84	Ont. Min. of the Env.	G
84	Ont. Min. of the Env.	G
84	Ont. Min. of the Env.	G
84	Ont. Min. of the Env.	G
84	Ont. Min. of the Env.	G
85	Univ. of Kyoto	G
85	Univ. of Kyoto	G
85	Univ. of Amsterdam	G
85	Ontario Ministry of Env.	G
85	Ontario Ministry of Env.	G
89	Univ. of Nebraska	G
89	Univ. of Nebraska	G
89	Univ. of Nebraska	G
89	Univ. of Nebraska	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
104	Lab. Inguin. Atmosferico, Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
105	MSW INCINERATORS	Milano, Italy
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
105	Urban Incinerators	ESP	FA
105	N/A	Furnace	Sludge
105	Rural Incinerators	Furnace	Sludge
105	Rural Incinerators	Furnace	Sludge
105	Rural Incinerators	ESP	FA
105	N/A	Furnace	Sludge
105	Rural Incinerators	ESP	FA
105	Urban Incinerators	ESP	FA
105	Rural Incinerators	Furnace	Sludge
105	Urban Incinerators	ESP	FA
105	Rural Incinerators	Furnace	Sludge
105	Urban Incinerators	ESP	FA
105	Rural Incinerators	Furnace	Sludge
105	Urban Incinerators	Furnace	Ash
105	Rural Incinerators	Furnace	Sludge
105	Urban Incinerators	Furnace	Ash
105	Rural Incinerators	Furnace	Sludge
105	Urban Incinerators	Furnace	Ash
105	N/A	Furnace	Sludge
105	Urban Incinerators	Furnace	Ash
105	N/A	Furnace	Sludge
105	Urban Incinerators	Stack	FA
105	N/A	Furnace	Sludge
105	Urban Incinerators	Stack	FA
105	N/A	Furnace	Sludge
105	Urban Incinerators	Stack	FA
105	N/A	Furnace	Sludge
105	Rural Incinerators	ESP	FA
105	N/A	Furnace	Sludge
105	Rural Incinerators	ESP	FA
105	N/A	Stack	FA
105	Rural Incinerators	ESP	FA
105	N/A	Stack	FA
105	Urban Incinerators	ESP	FA
105	N/A	Stack	FA
105	Urban Incinerators	ESP	FA
105	N/A	Stack	FA
105	Urban Incinerators	Furnace	Ash
105	N/A	Stack	FA
105	Urban Incinerators	Stack	FA
105	N/A	Stack	FA
105	Urban Incinerators	Stack	FA
105	N/A	Stack	FA
105	Rural Incinerators	ESP	FA
105	N/A	Furnace	Sludge
105	Urban Incinerators	ESP	FA
105	N/A	Furnace	Sludge
105	Urban Incinerators	Furnace	Ash
105	N/A	Furnace	Sludge
105	Urban Incinerators	Stack	FA
105	N/A	Furnace	Sludge
105	Rural Incinerators	ESP	FA
105	N/A	Furnace	Sludge

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
105	GC/MS	N/A	H6CDD/H6CDF
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	TCDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	P5CDD
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	H6CDD
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	H7CDD
105	GC/MS	N/A	H7CDD

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
105	177 ppb	N/A	Untreated MSW
105	ND	N/A	Proc. MSW (No Paper)
105	ND	N/A	Ag Products
105	15 ppb	N/A	Ag Products
105	ND	N/A	Ag Products
105	ND	N/A	Homogenized MSW
105	ND	N/A	Ag Products
105	100 ppb	N/A	Untreated MSW
105	ND	N/A	Ag Products
105	230 ppb	N/A	Untreated MSW
105	ND	N/A	Ag Products
105	70 ppb	N/A	Untreated MSW
105	ND	N/A	Ag Products
105	16 ppb	N/A	Untreated MSW
105	10 ppb	N/A	Ag Products
105	33 ppb	N/A	Untreated MSW
105	ND	N/A	Ag Products
105	340 ppb	N/A	Untreated MSW
105	ND	N/A	Proc. MSW (No Paper)
105	50 ppb	N/A	Untreated MSW
105	ND	N/A	Proc. MSW (No Paper)
105	80 ppb	N/A	Untreated MSW
105	ND	N/A	Proc. MSW (No Paper)
105	290 ppb	N/A	Untreated MSW
105	6 ppb	N/A	Proc. MSW (No Paper)
105	110 ppb	N/A	Untreated MSW
105	12 ppb	N/A	Proc. MSW (No Paper)
105	ND	N/A	Ag Products
105	ND	N/A	Proc. MSW (No Paper)
105	ND	N/A	Ag Products
105	ND	N/A	Homogenized MSW
105	40 ppb	N/A	Ag Products
105	ND	N/A	Homogenized MSW
105	160 ppb	N/A	Untreated MSW
105	ND	N/A	Homogenized MSW
105	50 ppb	N/A	Untreated MSW
105	5 ppb	N/A	Homogenized MSW
105	90 ppb	N/A	Untreated MSW
105	5 ppb	N/A	Homogenized MSW
105	N/A	N/A	Untreated MSW
105	ND	N/A	Homogenized MSW
105	510 ppb	N/A	Untreated MSW
105	ND	N/A	Homogenized MSW
105	ND	N/A	Ag Products
105	ND	N/A	Homogenized MSW
105	20 ppb	N/A	Untreated MSW
105	ND	N/A	Homogenized MSW
105	20 ppb	N/A	Untreated MSW
105	ND	N/A	Homogenized MSW
105	180 ppb	N/A	Untreated MSW
105	1 ppb	N/A	Homogenized MSW
105	30 ppb	N/A	Ag Products
105	1 ppb	N/A	Homogenized MSW

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I
105	Inst. Sull Inguin Atmos. Rome	I

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
105	MSW INCINERATORS	N/A
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
106	MSW INCINERATORS	Italy (6)
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
105	Urban Incinerators	Furnace	Ash
105	Urban Incinerators	ESP	FA
105	Urban Incinerators	Stack	FA
105	N/A	Furnace	Sludge
106	After Recycling	Furnace	Ash
106	After Compost Production	Cyclone	Sludge
106	After Compost Production	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	After Compost Production	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	After Compost Production	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	After Recycling	Furnace	Ash
106	N/A	Stack	FG/FA
106	After Recycling	Furnace	Ash
106	N/A	Cyclone	Sludge
106	After Recycling	Cyclone	Sludge
106	N/A	Cyclone	Sludge
106	After Recycling	Cyclone	Sludge
106	N/A	Cyclone	Sludge
106	After Recycling	Cyclone	Sludge
106	N/A	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	After Recycling	Furnace	Ash
106	N/A	Stack	FG/FA
106	N/A	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	N/A	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	N/A	Cyclone	Sludge
106	N/A	Stack	FG/FA
106	N/A	Furnace	Ash
106	After Compost Production	Cyclone	Sludge
106	N/A	Furnace	Ash
106	After Compost Production	Cyclone	Sludge
106	After Recycling	Cyclone	Sludge
106	After Compost Production	Cyclone	Sludge
106	N/A	Cyclone	Sludge
106	After Compost Production	Cyclone	Sludge
106	N/A	Cyclone	Sludge
106	After Compost Production	Furnace	Ash
106	N/A	Furnace	Ash
106	After Compost Production	Furnace	Ash
106	N/A	Stack	FG/FA
106	After Compost Production	Furnace	Ash
106	N/A	Furnace	Ash
106	N/A	Cyclone	Sludge
106	N/A	Furnace	Ash
106	After Compost Production	Furnace	Ash
108	N/A	Stack	FA
108	N/A	Stack	FA
108	N/A	Stack	FA
108	N/A	Stack	FA

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
105	GS	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
105	Train	N/A	Soxhlet/Xylene
105	GS	N/A	Soxhlet/Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	MM5T	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
106	GS	N/A	Xylene
108	N/A	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
105	GC/MS	N/A	H7CDF
105	GC/MS	N/A	OCDD
105	GC/MS	N/A	OCDF
105	GC/MS	N/A	H6CDD
106	GC	N/A	H6CDD
106	GC/MS	N/A	OCDD
106	GC	N/A	OCDD
106	GC	N/A	P5CDD
106	GC	N/A	H7CDD
106	GC	N/A	H7CDD
106	GC	N/A	H6CDD
106	GC/MS	N/A	TCDD
106	GC/MS	N/A	OCDD
106	GC/MS	N/A	H6CDD
106	GC	N/A	OCDD
106	GC	N/A	H6CDD
106	GC	N/A	OCDD
106	GC	N/A	TCDD
106	GC	N/A	H7CDD
106	GC	N/A	H6CDD
106	GC	N/A	H6CDD
106	GC	N/A	P5CDD
106	GC/MS	N/A	OCDD
106	GC	N/A	H7CDD
106	GC/MS	N/A	H7CDD
106	GC/MS	N/A	TCDD
106	GC/MS	N/A	P5CDD
106	GC/MS	N/A	H6CDD
106	GC	N/A	OCDD
106	GC/MS	N/A	OCDD
106	GC	N/A	H6CDD
106	GC	N/A	P5CDD
106	GC/MS	N/A	OCDD
106	GC	N/A	H7CDD
106	GC	N/A	OCDD
106	GC/MS	N/A	OCDD
106	GC	N/A	H7CDD
106	GC	N/A	OCDD
106	GC	N/A	H6CDD
106	GC/MS	N/A	H7CDD
106	GC/MS	N/A	OCDD
106	GC	N/A	H6CDD
106	GC	N/A	OCDD
106	GC	N/A	TCDD
106	GC	N/A	H7CDD
106	GC	N/A	TCDD
106	GC/MS	N/A	P5CDD
106	GC	N/A	OCDD
106	GC	N/A	H6CDD
108	GC/MS	N/A	H7CDF
108	GC/MS	N/A	P5CDD
108	GC/MS	N/A	HCDF
108	GC/MS	N/A	HCDD

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
105	25 ppb	N/A	Untreated MSW
105	490 ppb	N/A	Untreated MSW
105	60 ppb	N/A	Untreated MSW
105	ND	N/A	Homogenized MSW
106	ND	N/A	MSW
106	ND	N/A	MSW
106	5 ng/g	N/A	MSW
106	240 ng/g	N/A	MSW
106	5 ng/g	N/A	MSW
106	400 ng/g	N/A	MSW
106	ND	N/A	MSW
106	ND	N/A	MSW
106	8 ng/g	N/A	MSW
106	180 ng/g	N/A	MSW
106	7 ng/g	N/A	MSW
106	310 ng/g	N/A	MSW
106	12 ng/g	N/A	MSW
106	50 ng/g	N/A	MSW
106	6 ng/g	N/A	MSW
106	175 ng/g	N/A	MSW
106	ND	N/A	MSW
106	115 ng/g	N/A	MSW
106	510 ng/g	N/A	MSW
106	3 ng/g	N/A	MSW
106	290 ng/g	N/A	MSW
106	20 ng/g	N/A	MSW
106	80 ng/g	N/A	MSW
106	160 ng/g	N/A	MSW
106	510 ng/g	N/A	MSW
106	490 ng/g	N/A	MSW
106	185 ng/g	N/A	MSW
106	20 ng/g	N/A	MSW
106	ND	N/A	MSW
106	113 ng/g	N/A	MSW
106	1 ng/g	N/A	MSW
106	10 ng/g	N/A	MSW
106	1 ng/g	N/A	MSW
106	545 ng/g	N/A	MSW
106	ND	N/A	MSW
106	230 ng/g	N/A	MSW
106	3 ng/g	N/A	MSW
106	33 ng/g	N/A	MSW
106	3 ng/g	N/A	MSW
106	175 ng/g	N/A	MSW
106	1 ng/g	N/A	MSW
106	16 ng/g	N/A	MSW
106	100 ng/g	N/A	MSW
106	390 ng/g	N/A	MSW
106	ND	N/A	MSW
108	1130 ppb	N/A	MSW
108	800 ppb	N/A	MSW
108	1600 ppb	N/A	MSW
108	1370 ppb	N/A	MSW

REF #	SAMPLING ORGANIZATION	RATING
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	G
105	Inst. Sull Inguin Atmos. Rome	I
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	I
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	G
106	Inst Chim Anali, Univ di Roma	I
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE TYPE	FACILITY
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
108	MSW INCINERATORS	25 Installations
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
*111	MSW INCINERATORS	U.S.
115	MSW INCINERATORS	SWARA Plant, Canada
115	MSW INCINERATORS	SWARA Plant, Canada
115	MSW INCINERATORS	SWARA Plant, Canada
115	MSW INCINERATORS	SWARA Plant, Canada
115	MSW INCINERATORS	SWARA Plant, Canada
115	MSW INCINERATORS	SWARA Plant, Canada
115	MSW INCINERATORS	SWARA Plant, Canada
119	MSW INCINERATORS	Ames, Iowa
119	MSW INCINERATORS	Chicago NW
119	MSW INCINERATORS	Chicago NW
119	MSW INCINERATORS	Chicago NW
119	MSW INCINERATORS	Chicago NW
120	MSW INCINERATORS	5 Incin. (North American)
120	MSW INCINERATORS	5 Incin. (North American)
120	MSW INCINERATORS	5 Incin. (North American)
120	MSW INCINERATORS	5 Incin. (North American)
126	MSW INCINERATORS	KVA, Zurich-Josefstrasse
130	MSW INCINERATORS	Utility Plant (1)
130	MSW INCINERATORS	Utility Plant (1)
130	MSW INCINERATORS	Utility Plant (1)

MUNICIPAL WASTE COMBUSTORS

REF #	SOURCE CHARACT.	PROCESSES	SAMPLE
108	N/A	ESP	FA
108	N/A	Stack	FA
108	N/A	ESP	FA
108	N/A	Stack	FA
108	N/A	Stack	FA
108	N/A	Stack	FA
108	N/A	ESP	FA
108	N/A	Stack	FA
108	N/A	ESP	FA
108	N/A	ESP	FA
108	N/A	ESP	FA
108	N/A	Stack	FA
108	N/A	ESP	FA
*111	Converted Coal Boiler	Stack	FG/FA
*111	Incinerator-Boiler	Stack	FG/FA
*111	Converted Coal Boiler	Stack	FG/FA
*111	Incinerator-Boiler	Stack	FG/FA
*111	Converted Coal Boiler	Stack	FG/FA
*111	Converted Coal Boiler	Stack	FG/FA
*111	Incinerator-Boiler	Stack	FG/FA
*111	Incinerator-Boiler	Stack	FG/FA
115	Traveling Grate Boiler	Stack	FG/FA
115	Traveling Grate Boiler	Grate	Ash
115	Traveling Grate Boiler	Stack	FG/FA
115	Traveling Grate Boiler	ESP	Ash
115	Traveling Grate Boiler	Grate	Ash
115	Traveling Grate Boiler	ESP	Ash
115	Traveling Grate Boiler	-----	Feed
119	Coal/RDF Incineration (1200C)	Stack/ESP	FG/FA
119	Raw Refuse Incineration 650C)	ESP	FA
119	Raw Refuse Incineration 650C)	Stack	FG
119	Raw Refuse Incineration 650C)	Stack	FG
119	Raw Refuse Incineration 650C)	Furnace	Ash
120	N/A	Stack	FA
120	N/A	Stack	FA
120	N/A	Stack	FA
120	N/A	Stack	FA
126	N/A	Stack	FA/FG
130	N/A	ESP	FA
130	N/A	Hopper	FA
130	N/A	Stack	FG

MUNICIPAL WASTE COMBUSTORS

REF #	METHOD	SAMPLE NUM.	EXTRACTION
108	GS	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	GS	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	GS	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	GS	N/A	Soxhlet/Hexane
108	GS	N/A	Soxhlet/Hexane
108	GS	N/A	Soxhlet/Hexane
108	N/A	N/A	Soxhlet/Hexane
108	GS	N/A	Soxhlet/Hexane
*111	MM5T	3 Tests/2 Days	Methanol/Hexane
*111	MM5T	3 Tests/4 Days	Methanol/Hexane
*111	MM5T	3 Tests/2 Days	Methanol/Hexane
*111	MM5T	3 Tests/4 Days	Methanol/Hexane
*111	MM5T	3 Tests/2 Days	Methanol/Hexane
*111	MM5T	3 Tests/2 Days	Methanol/Hexane
*111	MM5T	3 Tests/4 Days	Methanol/Hexane
*111	MM5T	3 Tests/4 Days	Methanol/Hexane
115	MM5T	15 Runs	N/A
115	GS	15 Runs	N/A
115	MM5T	15 Runs	N/A
115	GS	15 Runs	N/A
115	GS	15 Runs	N/A
115	GS	15 Runs	N/A
115	GS	15 Runs	N/A
119	MM5T/GS	9 Days	Soxhlet/Benzene (8-24 hr)
119	GS	10 Days	Soxhlet/Benzene (8-24 hr)
119	MM5T	10 Days	Soxhlet/Benzene (8-24 hr)
119	MM5T	10 Days	Soxhlet/Benzene (8-24 hr)
119	GS	10 Days	Soxhlet/Benzene (8-24 hr)
120	Filter	5 Samples	Soxhlet
120	Filter	5 Samples	Soxhlet
120	Filter	5 Samples	Soxhlet
120	Filter	5 Samples	Soxhlet
126	Filter	N/A	N/A
130	GS	N/A	Soxhlet
130	GS	N/A	Soxhlet
130	MM5T	N/A	Soxhlet

MUNICIPAL WASTE COMBUSTORS

REF #	ANALYSIS	DETECTION LIMITS	ISOMER
108	GC/MS	N/A	HCDD
108	GC/MS	N/A	H7CDD
108	GC/MS	N/A	OCDD
108	GC/MS	N/A	OCDD
108	GC/MS	N/A	OCDF
108	GC/MS	N/A	TCDF
108	GC/MS	N/A	HCDF
108	GC/MS	N/A	P5CDF
108	GC/MS	N/A	OCDF
108	GC/MS	N/A	H7CDF
108	GC/MS	N/A	TCDD
108	GC/MS	N/A	TCDD
108	GC/MS	N/A	TCDF
*111	GC/MS	N/A	TCDD
*111	GC/MS	N/A	PCDF
*111	GC/MS	N/A	PCDF
*111	GC/MS	N/A	TCDF
*111	GC/MS	N/A	PCDD
*111	GC/MS	N/A	TCDF
*111	GC/MS	N/A	TCDD
*111	GC/MS	N/A	PCDD
115	GC/MS	N/A	PCDD
115	GC/MS	N/A	PCDD
115	GC/MS	N/A	PCDF
115	GC/MS	N/A	PCDD
115	GC/MS	N/A	PCDF
115	GC/MS	N/A	PCDF
115	GC/MS	N/A	PCDF
119	GC/MS	.25 ng/dscm	PCDD/PCDF
119	GC/MS	0.5 ng/g	PCDD/PCDF
119	GC/MS	.25 ng/dscm	TCDD
119	GC/MS	.25 ng/dscm	2378 TCDD
119	GC/MS	0.5 ng/g	PCDD/PCDF
120	GC/MS	0.5 ng/g	PCDF
120	GC/MS	0.5 ng/g	TCDD
120	GC/MS	0.5 ng/g	PCDD
120	GC/MS	0.5 ng/g	TCDF
126	GC/MS	N/A	PCDD/PCDF
130	GC/MS	N/A	PCDF
130	GC/MS	N/A	PCDF
130	GC/MS	N/A	PCDF

MUNICIPAL WASTE COMBUSTORS

REF #	ISOMER CONC.	DATA VARIABILITY	PRECURSORS
108	326 ppb	80 - 1200 ppb	MSW
108	1370 ppb	N/A	MSW
108	106 ppb	110 - 266 ppb	MSW
108	310 ppb	N/A	MSW
108	140 ppb	N/A	MSW
108	460 ppb	N/A	MSW
108	361 ppb	109 - 870 ppb	MSW
108	960 ppb	N/A	MSW
108	18 ppb	20 - 26 ppb	MSW
108	177 ppb	89 - 407 ppb	MSW
108	54 ppb	5 - 110 ppb	MSW
108	100 ppb	N/A	MSW
108	111 ppb	13 - 223 ppb	MSW
*111	1.6 ng/m3	0.4 - 3.9 ng/m3	RDF
*111	5586 ng/m3	1,991 - 8,350 ng/m3	Refuse
*111	81.9 ng/m3	26.0 - 169.2 ng/m3	RDF
*111	2512 ng/m3	697 - 8,350 ng/m3	Refuse
*111	34.3 ng/m3	7.7 - 60.3 ng/m3	RDF
*111	16.5 ng/m3	8.2 - 30.8 ng/m3	RDF
*111	443 ng/m3	253 - 770 ng/m3	Refuse
*111	3,221 ng/m3	1,236 - 4,297 ng/m3	Refuse
115	3.68 ug/m3	1.3 - 11.1 ug/m3	RDF
115	0.5 ng/g	ND - 3.3 ng/g	RDF
115	7.89 ug/m3	3.7 - 12.5 ug/m3	RDF
115	23.0 ng/g	6.2 - 94.2 ng/g	RDF
115	0.6 ng/g	ND - 3.9 ng/g	RDF
115	46 ng/g	22 - 105 ng/g	RDF
115	2.3 ng/g	ND - 25 ng/g	RDF
119	ND	N/A	85% Coal/15% RDF
119	ND	N/A	Raw MSW
119	6.3 ng/dscm	N/A	Raw MSW
119	0.41 ng/dscm	N/A	Raw MSW
119	ND	N/A	Raw MSW
120	517.3 ng/g	64.0 - 2363 ng/g	MSW
120	20.6 ng/g	2.4 - 85 ng/g	MSW
120	236.5 ng/g	31.2 - 203.1 ng/g	MSW
120	45.7 ng/g	4.4 - 209 ng/g	MSW
126	N/A	4 - 50 ng/m3	MSW
130	Detected	N/A	MSW/Coal
130	Detected	N/A	MSW/Coal
130	Detected	N/A	MSW/Coal

MUNICIPAL WASTE COMBUSTORS

REF #	SAMPLING ORGANIZATION	RATING
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
108	Univ. of Amsterdam	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
*111	Scott Env. Services	G
115	Ontario Research Found.	G
115	Ontario Research Found.	G
115	Ontario Research Found.	G
115	Ontario Research Found.	G
115	Ontario Research Found.	G
115	Ontario Research Found.	G
115	Ontario Research Found.	G
119	TRW	G
119	TRW	G
119	TRW	G
119	TRW	G
119	TRW	G
120	Texas A&M Univ. Col of Vet Med	G
120	Texas A&M Univ. Col of Vet Med	G
120	Texas A&M Univ. Col of Vet Med	G
120	Texas A&M Univ. Col of Vet Med	G
126	Dubendorf, Swit. F.M.T. & E.I.	P
130	DOE	G
130	DOE	G
130	DOE	G

APPENDIX B

DETERMINATION OF SAMPLE SIZE

APPENDIX B. DETERMINATION OF SAMPLE SIZE

PROBLEM: Determine number of municipal waste combustors that should be tested in order to estimate the average dioxin emission rate within a 5 ng/m^3 interval with 95 percent confidence.

Municipal Waste Combustors: Total population = 40

Site	TCDD (ng/m^3)
A	240
B	29.7
C	6.3
D	3.15
E	1.2
F	ND

Assume: Sampling from a finite population without replacement

$$n = \frac{N z^2 SD^2}{d^2 (N-1) + Z^2 SD^2}$$

n = sample size
N = population size = 40
Z = reliability coeff = 2 (95% confidence)
SD = standard deviation
d = confidence interval = 5 ng/m^3

Case I: (all sites listed)

= 46.7
SD - 87.0

$$n = \frac{40 (2)^2 (87)^2}{5^2 40-1) + 2^2 (87)^2} = 39$$

Case II: (drop sites with highest and lowest average TCDD levels)
= 10.1
SD = 11.46

$$n = \frac{40 (2)^2 (11.46)^2}{5^2 (40-1) + 2^2 (11.46)^2} = 14$$

SOLUTION: In order to estimate average dioxin emission rate for municipal waste combustors, 14-39 sources should be tested. Based on 95% confidence, results would be within 5 ng/m^3 of true mean.

APPENDIX C

CURRENT REFERENCE LIST

LIST OF REFERENCES PERTAINING TO CHLORINATED DIOXIN AND FURAN AIR EMISSIONS

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16. ABSTRACT

The objective of Tier 4 of the National Dioxin Study is to determine if combustion sources emit significant amounts of dioxins to the atmosphere. The literature review was performed prior to the initiation of the Tier 4 dioxin emissions test program. The purpose of the literature review was to summarize the existing dioxin emissions data base for combustion sources and to develop a list of candidate source categories for the test program.

The literature review presents a summary of the available dioxin emissions data and discusses factors affecting dioxin emissions from combustion sources. A preliminary ranked list of source categories recommended for the Tier 4 test program is presented, along with an overview of the recommended testing approach.

A tabular summary of the dioxin emissions data base and a comprehensive reference list are included as appendices.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Emissions Combustion Sources Dioxin Furans 2,3,7,8-tetrachlorodibenzo-p-dioxin TCDD TCDF PCDD	PCDF Data Assessment Combustion Conditions Chlorine Combustion	Air Pollution Emissions Data	

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